THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. CX. No. 2447.] LONDON, APRIL 5, 1910. [62ND YEAR. PRICE 6d.

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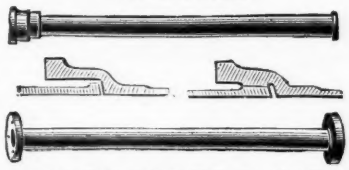

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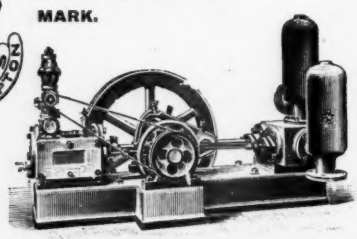
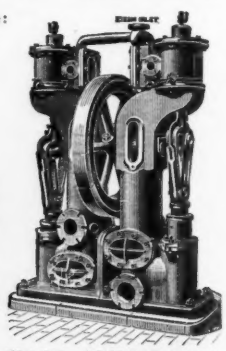


Fig. 685. "RELIABLE" STEAM PUMP FOR TAR AND THICK FLUIDS.



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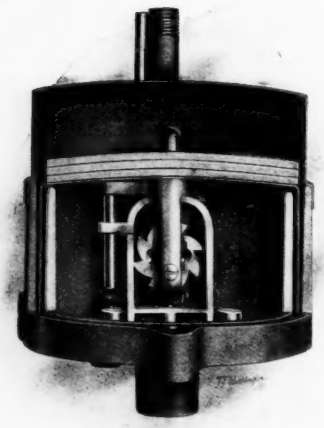

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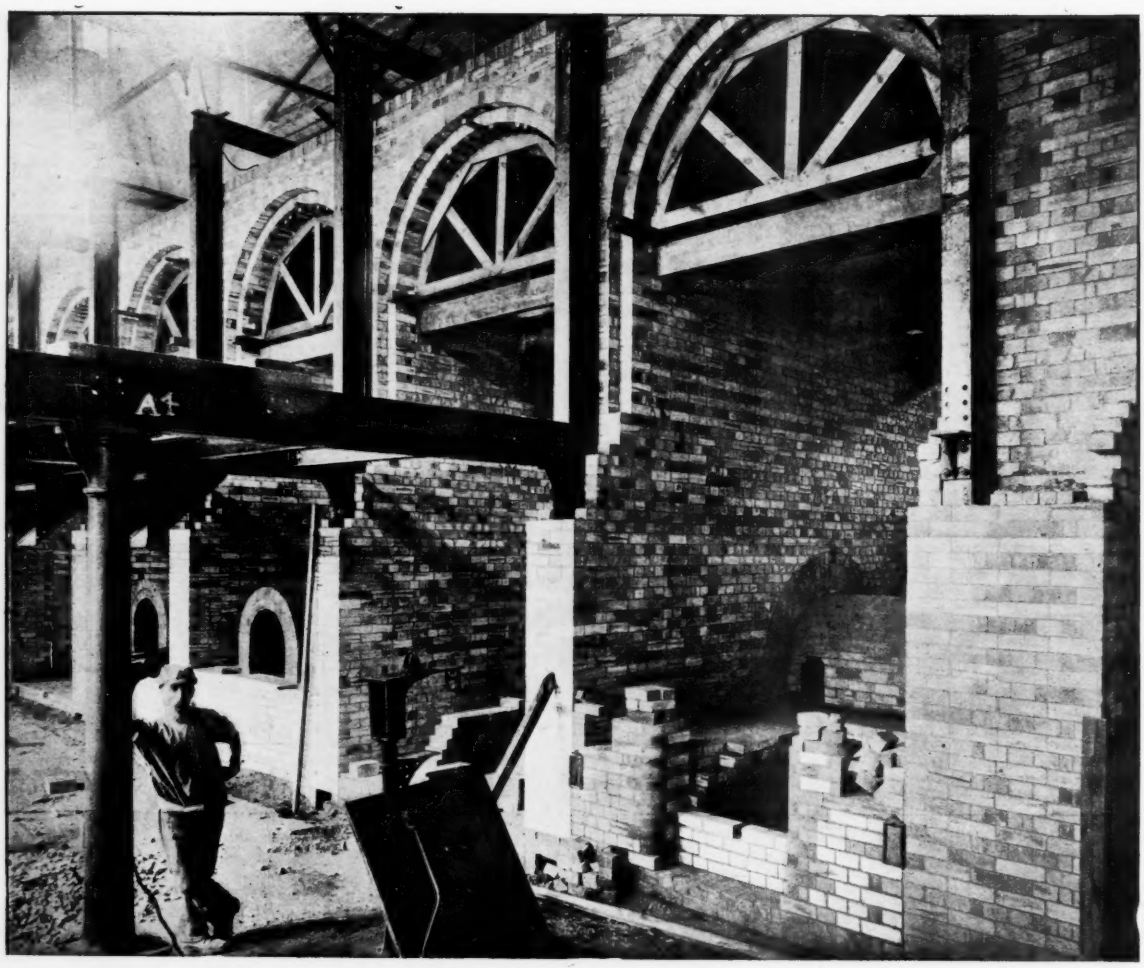

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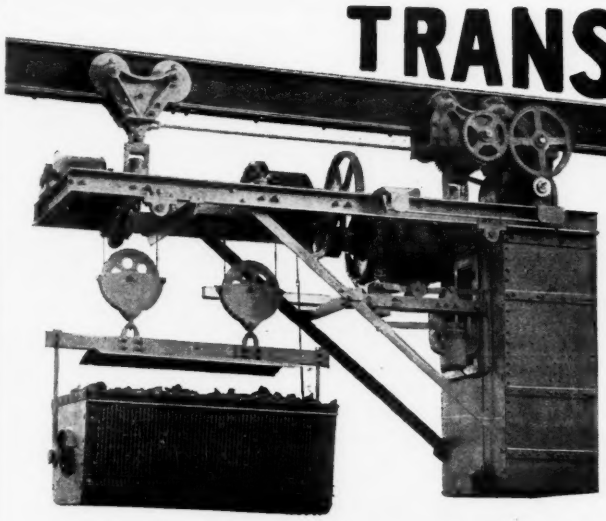

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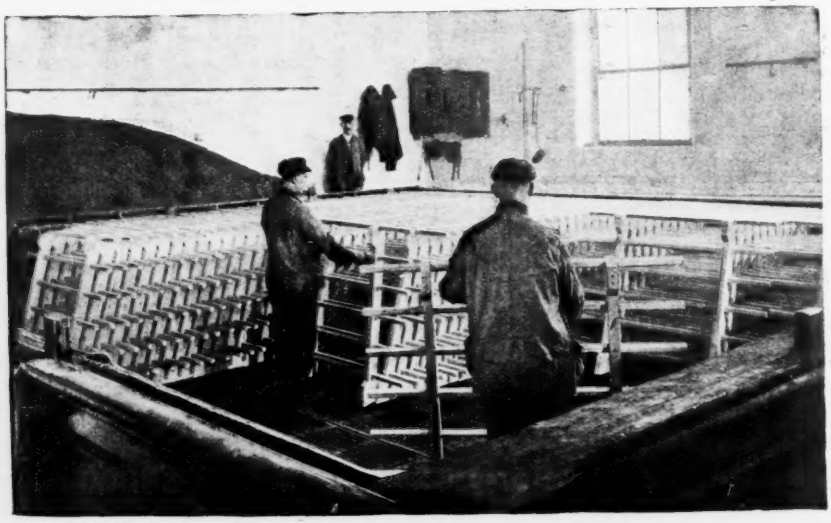

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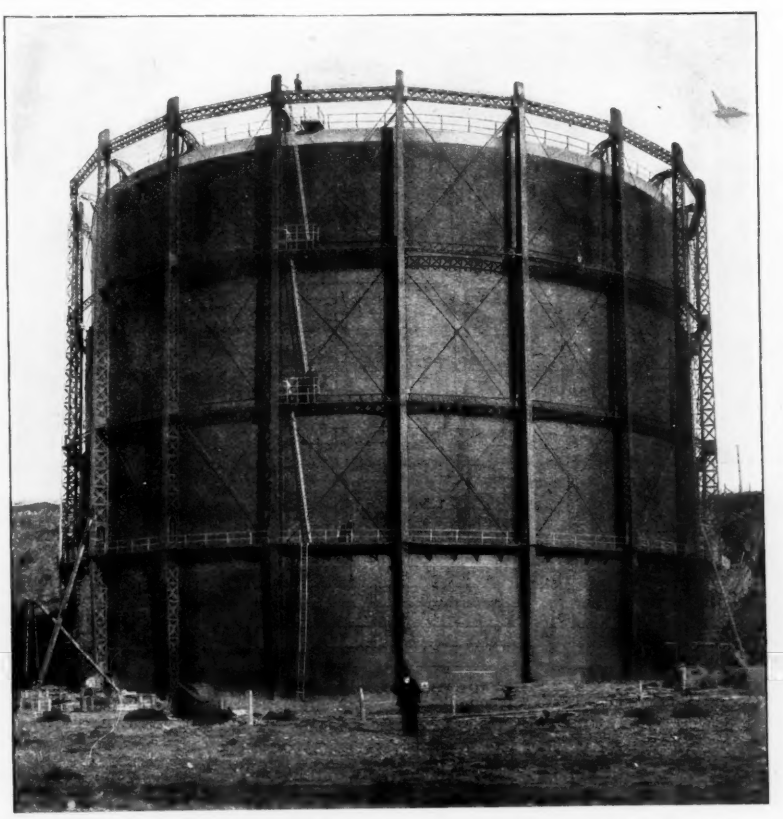

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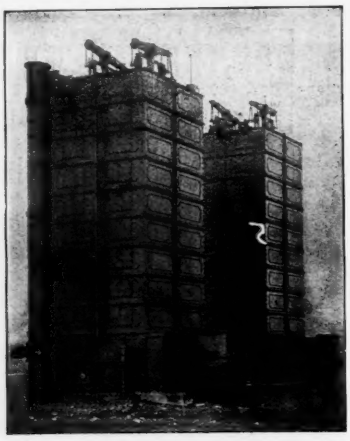

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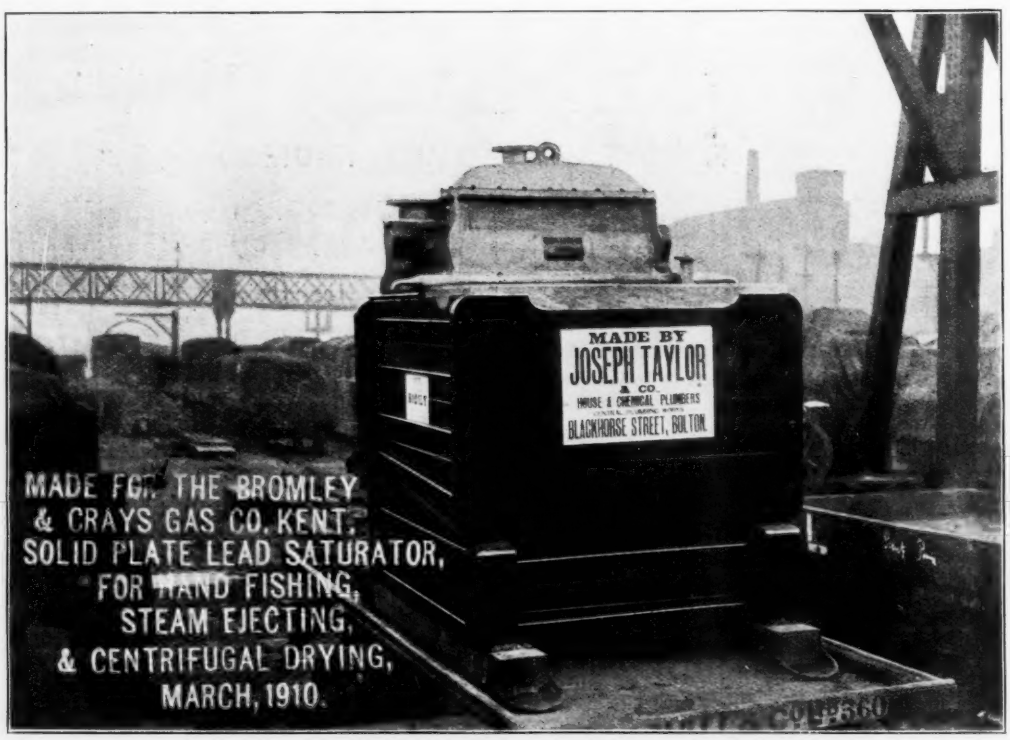

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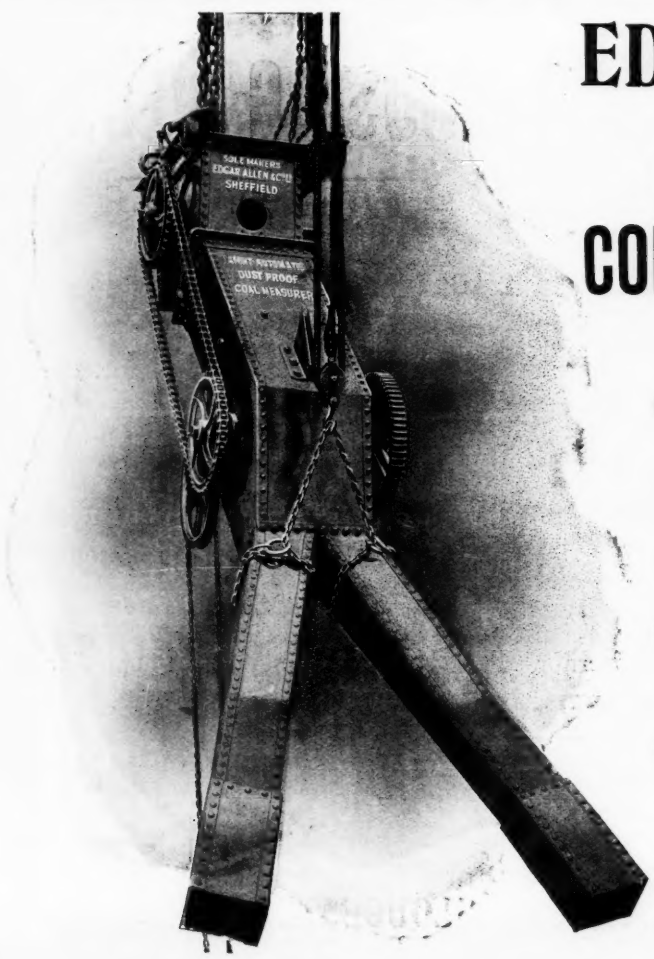

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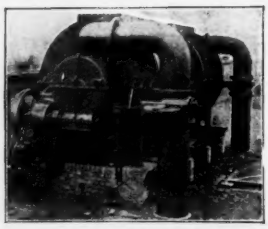

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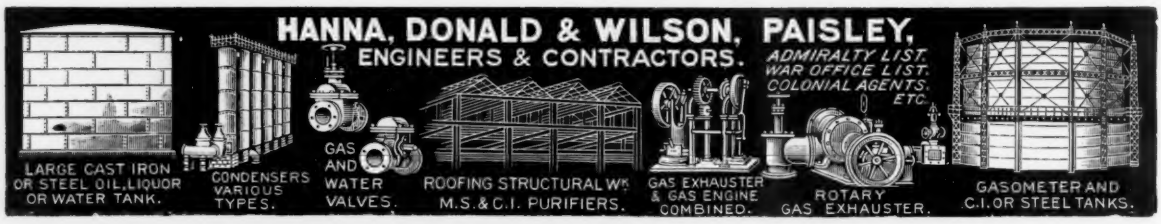
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EDITORIAL NOTES—GAS, &c.

An Extensive Gas-Works Scheme.

Of large gas-works schemes, after Beckton and East Greenwich, New York has given us the Astoria works, Berlin the Mariendorf works, Edinburgh the Granton works, and Glasgow the Provan; and now Paris has decided upon a scheme which will involve an expenditure of £7,200,000 (to be in major part spent on new works, and extensions at the principal existing stations), in addition to the sum of about £1,880,000 expended in the last two years as a matter of urgency. There are two points that are of extreme interest attaching to these enormous expenditures. The first is: What has caused the imperative considerable outlay during the last two years? The second is: Do the prospects of the gas industry warrant such an extensive scheme for Paris, as one requiring an outlay of between 7 and 8 millions sterling? Regarding the first question, there is no disparagement of the old Gas Company in saying that, prior to their giving up possession of the gas supply of Paris, neither in works nor price was the gas supply of the capital of France on the lines that it ought to have been. The Company were "cribb'd, cabin'd, confin'd" by the onerous conditions of their concession, and by the financial obligations to the City Exchequer imposed upon them for the privilege of a limited tenure and the rendering of a public service. The price of gas was necessarily high. Up to 1903, no less than 6s. 9d. per 1000 cubic feet was charged; and since then 4s. 6d.—prices which are the effects of indirect and inequitable taxation, and the lower of which is now nearly double that of the average price in London. Under the circumstances of that 6s. 9d. price, it would have been astonishing if the consumption of gas had increased by leaps and bounds. It did not do so. But since the reduction to 4s. 6d.—high as that price still is, according to British notions—the sales have piled up by 4202 million cubic feet, from 10,236 to 14,438 millions. The number of consumers has increased in the like period by 175,453. In these figures, the Municipal Council of Paris ought to see a practical lesson for them—that the fattest profits are not necessarily made by the highest prices, but rather, oftentimes, by the greater extent of business to be obtained at lower prices. There would never have been this considerable broadening-out of the business in such a short span of years, nor the prospect of so considerable an extension as that forecast, had the price of gas not been reduced. It is to be hoped that after this the policy of lower gas prices will be fostered in Paris in the greatest possible measure.

And as to the present necessity for such heavy expenditure upon works. With the sands of time running out for them during their latter years, it was natural the old Gas Company should not then commit themselves to more capital expenditure than was requisite. Those members of the Gas Institute who inspected the Clichy station of the Company at the time of the International Exhibition of 1900, and those British gas engineers who visited La Villette works at the time the Parisienne projector machine was designed by the Company's engineering staff, will remember something as to the characteristics of the plant then. Not all of it was striking in the matter of modernity; and some years have sped their way since then. Hence, with the rapid increases of business on the large scale while gas has been at a more reasonable—but not yet sufficiently reasonable—price, there has had to be prompt expenditure in extending the existing plant, and thought on more elaborate lines has had to be taken for the morrow, bringing within range of consideration the rescuing from wasteful conditions of material economies. These are not by any means reflections on the administrative or technical staffs of the old Company; but they are reflections on the deterrent and uneconomical conditions under which they were compelled to operate.

Are the prospects of the gas industry favourable to the execution of such a vast scheme of construction, re-construction, extension, and reorganization as that now adumbrated? There can only be an affirmative answer. Paris itself, in its recent years' experiences, gives a resonant reply. The city has extensive generating-stations for electricity supply, and all the best parts of Paris are completely cabled. Notwithstanding this and the price-obstruction to the greatest vitality in gas-supply development and to freedom in meeting the electrical competition, despite, too, the severance of the suburban communes in 1906 (in which there was the prospect of very prolific expansion), the gas industry of the city has, as already remarked, added to its business stature since 1902 no less than 4202 million cubic feet. That is a no mean achievement under the circumstances; and it evinces a remarkable latent virility, as well as a considerable undeveloped field for business enterprise. And Paris has not even yet obtained the fullest benefit from its gas supply. Beyond all this, the scheme finds, in anything but an infinitesimal degree, justification on economic grounds, through the savings that will accrue in working expenditure. Half-a-dozen small and uneconomical works are now to be abandoned, and their sites disposed of. The Landy, Clichy, and La Villette stations are to be extended; and new works concentration is to commence to the south-east of the city. The minimum saving in works costs has been placed at 4d. to 5¼d. per 1000 cubic feet. New tar and chemical works are to be erected; certain of the present residual products plant is to be discarded, and other existing plant enlarged. The distribution system is not to escape necessary revision, to meet the augmentation of demand; and, in this connection, it is interesting to learn that representatives of the new Company's technical staff, as well as those of the principal Suburban Company, have been in Edinburgh studying Mr. Herring's work there in high-pressure distribution. The scheme, too, involves—also in the name of economy—the provision of bottom-doored railway waggons. Economy is printed all over the scheme, upon which, year by year, until completed, expenditure will progress until it reaches to something like the estimated enormous sum.

The Company's Engineers are to be most heartily congratulated not only on the endorsement of their scheme for meeting immediate and prospective requirements, and for producing working economies, but upon the splendid engineering opportunities that such a scheme and expenditure unfold for them. The Company have done wisely in taking the "bull by the horns;" and, judging from the details in an article elsewhere, they will show to the people of Paris that the comprehensive scheme has been wisely conceived, and that it will represent a financial success of first-class order.

Factors in Measurement Error—
Juniors and University Lectures and Work.

When one has read an address such as that Mr. Franklin Thorp (who, as is well known, is identified with the meter industry in its various branches—meters for productive, commercial, and scientific registration) delivered, as President of the Manchester Junior Association, last Saturday, one's mind drifts to the inquiry as to whether sufficient use is made by the industry's technical organizations of the practical, scientific, and constructive experiences that lie at the back of the manufacturing and trading part of the industry. This is a topic upon which we have dwelt before; but it naturally arises again on this occasion. Mr. Thorp, in connection with the Manchester juniors, occupies, in view of his commercial relations, a unique position in being their President for this year. His unremitting work among them, through an interest in cultural pursuits distinct from those of commerce, deserves the reward; but it is probable that he will be the first and only (we use the designation inoffensively) "trader" who will tenant the most distinguished office in the Association, as membership on the part of those having commercial intercourse with the gas-supply industry has been debarred. As to the wisdom or otherwise of this, there is no occasion for argument; but we do say that, in

the best interests of professional knowledge, the way must be kept open with our manufacturing industry for uninterrupted intercommunication on matters of technical import. The manufacturer's technical interest, researches, and experiences are, as a rule, concentrated in a single direction; whereas the gas-supply engineer's technical interests rove over a large field, and are in every part limited by his opportunities. The concentrated interest of the manufacturer, if he lives up to the times, must bring him into contact with all the various phases and details of his work and business. When, therefore, he is invited to speak upon a technical matter, his choice naturally falls into the lines of his especial interest, and his information is of exceptional value.

And so we have Mr. Thorp in one part of his address pointing, from his experience, lessons that will be of service to the gas engineer from their suggestiveness in more ways than one. With masterly ability and conscientious propriety, he steered clear of everything that could have been construed as taking an undue advantage of his position, and of the confidence of those who had honoured him with it. The points the President made in this connection may not be altogether new, but certain it is they are not general knowledge, or the effects of the disregard of them would not be so common as they are. He showed how the flow of gas in mains varies much more than one would expect from observation of the pressure-gauge. The point was illustrated by the results of personal investigation; and it was made perfectly clear that many meters are called upon to perform a greater duty than that for which they are constructed, though they may not be passing in an hour a larger volume of gas than that for which they are designed. To instal a meter of too small a capacity is foolish; inasmuch as its overloading may mean loss of money, as well as organic and functional injury. With the increase of overloading, the percentage of error increases, to the disadvantage of the gas supplier. Further, Mr. Thorp gives some practical advice regarding the testing of station meters by a holder; and he proves the soundness of his contentions again by the results of personal investigation. The errors that may and do arise through the variations of temperature in the holder itself are considerable; and, in the end, it is seen that his counsel is wise, that, in testing a meter by a holder, a night should be chosen when the temperature varies as little as possible, and the gas in the holder should be reduced to normal temperature and pressure at both the commencement and end of the test. These are only indications of points of the part of the address wherein Mr. Thorp's endeavour is to show where differences of error may arise from factors not generally taken into consideration.

A matter of much importance in connection with the technical advancement of the juniors was dealt with in the second part of the address. In considering the question of specialized technical instruction in the gas industry, and in the later developments in this direction—although the professional juniors of the industry have their own organizations, and it is such as those constituting the membership of those organizations that all educational effort in the industry is designed to personally benefit, and through them the industry itself—these organizations have not hitherto been in any way taken into counsel. It cannot be denied that the Junior Associations have cut out for themselves a good position in the gas industry; and the members are working heart and soul for the cause of the industry, and are losing no opportunities to that end. If this fact be recognized (as it should be), the more extended will be the respect already gained, and the greater will be the sympathy in a matter that has now to be discussed. In Mr. Thorp's address we are brought *vis-à-vis* with a question that has been recognized, though little talked about. But the juniors themselves are now—not from any opposition to the Leeds University scheme and efforts, but in their own interests in other parts of the country—making the matter a cause of (shall we say?) complaint on the ground of inequality in opportunity. While there are indisputable advantages in building up a strong centre for specialized educational work and for research—and the stronger the centre is in connection with any one industry the better—there is the one admitted disadvantage, whatever is done (and the Leeds University authorities have not been slow in doing all possible), that distance, time, and expense put a limit upon the number of those who are able to participate in the privileges. It is a difficult matter. But it is quite natural that the progressive juniors should desire, if there is a way, of seeing a better distribution of those privileges.

There are among the Manchester juniors (though Leeds is nearer to them than to the juniors of the Midlands, the Southern and more Northern Counties, and Scotland) several who would like to participate, but cannot do so, as students in the lectures and work proceeding at the Leeds University. As a result for the juniors of the Manchester district, there is a proposal on foot (as sketched by Mr. Thorp in his address) for a course of lectures at the Manchester University by men of special qualification in technical gas affairs; and a second scheme proposes a course of lectures, demonstrations, and practical work for advanced students at the University, from October to March, at a maximum fee of £2 2s. per course of sixteen lectures of two hours each. At the head of the department in which these lectures and practical work would be incorporated is Professor Harold B. Dixon, whose standing as an authority on matters relating to the chemical and physical properties of gases requires no special mention in these pages. There is the evidence of a distinct desire between University and Association to cultivate closer relationships; and, recognizing as we have the need for all opportunities for broadening knowledge among those into whose hands will hereafter fall the technical responsibilities of the gas industry, and advocating as we have too the formation of the junior organizations, and the provision of the very best and widest means of technical as well as practical education, it would ill-become us to do other than give cordial support to the aspirations of the juniors of the Manchester district who cannot participate in what the Leeds University has to offer, and to ask all concerned in the administration of the gas undertakings in the Manchester area to see what can be done to help the juniors in the matter. Let it be remembered, that all work of the kind is for the benefit not of the individual only, but for the gas industry at large. This, however, has also to be remembered, that the more that is done in this way apart from Leeds University, curtails the field whence it can hope to draw gas engineering students; and therefore it may at once be put forward as a suggestion, seeing that Leeds has been chosen as the head and centre of technical educational work and research for the gas industry, as to whether arrangements could not be made whereby the Leeds and Manchester Universities might work hand in hand in this matter—say, by lectures delivered at Leeds being repeated at Manchester. This is only an unconsidered idea; but from it (Professor Dixon showed on Saturday that the relations between the Manchester and the Leeds Universities were of the most cordial) there may be evolved a way through which the needed service and usefulness may be achieved, and economically. The Manchester scheme, however, is only at present in embryo; but there are those who ardently desire to see consummation, and now is the time for serious consideration, in which we hope, as suggested by Mr. Whatmough at the meeting of the Manchester juniors, the Senior District Institution will have an opportunity of joining.

Sulphate of Ammonia and Beet Cultivation.

THE subject of the cultivation of beetroot in this country for the purpose of establishing a home sugar industry has again arisen. It is one of those questions that come up periodically; but, from sheer apathy and want of encouragement, it sinks out of view as regularly as it appears. Here is a big industry at hand with great potentialities, if only it were taken up in a proper manner, and given the capital and protection that are required—the latter in view of the strength and established position of the Continental sugar industry, which naturally would be very loth to lose the trade with this country. It is obvious that the development of such an industry in this country would confer benefit on home agriculture, engineering, sulphate of ammonia producers, and labour. In an article in the "Daily Telegraph," it is stated that no less than £20,000,000 is year by year paid by the people of this country for sugar, of which something like £17,000,000 goes to the producers of beetroot sugar on the Continent. If it be at all possible—and there is no apparent reason why it should not be possible—a large part of the last-named enormous sum should be kept and utilized at home; but there will be little result if the movement to that end is not very seriously made. It cannot be said that the soil or the climate of this country is not suitable for beet cultivation. Some ten years ago, Lord Denbigh carried out some exceedingly successful experiments at Lutterworth in the growth of beetroot; and many other

people, in most parts of the country, have been similarly gratified with the outcome of trials. As a matter of fact, these point to the production per acre of land being greater than on the Continent. There are agriculturists who think that on English soil 20 tons of beet per acre might be grown; Lord Denbigh says that from 16 to 17 tons per acre should certainly be produced. The average weight per acre on the Continent is, however, only 13 tons. It is somewhat significant of what is considered abroad to be the capability of this country in this respect when it is found that contracts are being placed by a firm of Dutch sugar manufacturers for the production of sugar beetroot for exportation to their factories in Holland. Lord Denbigh has undoubtedly good grounds for his conviction that the effects of establishing a sugar industry in our midst, if adequately encouraged, would be far-reaching, and that they would not be confined to agriculturists. His Lordship is proposing to ascertain, by means of questions in the House of Lords, as to how far the Government will be prepared to give the necessary encouragement.

In these columns only a fortnight since [March 22, p. 782], we were writing on the subject of the greater cultivation of the home market for sulphate of ammonia, and pointing out how far we are behind Germany in the matter of the home absorption of the commodity. The rapid growth of the production of sulphate of ammonia in Germany and the expansion of its use there, are among the surprises in connection with it. The consumption has been going up by leaps and bounds, until, as we have recently been told, it was in 1908 no less than 284,000 tons, which, if calculated out at an average price of £11 10s. (taken as an approximate, and not an actual, figure), represents a value of £3,266,000. The figures make our own look very insignificant. A large proportion of this German consumption is utilized for the cultivation of beetroot, for which (and this is another consideration in encouraging the sugar industry in this country) sulphate of ammonia cannot be replaced by the nitrogen of nitrate of soda. Germany in this connection has a prominent characteristic. Statistics regarding its productions, commerce, and so on are available; but there is no great show of liberality in the information that it affords in respect of practical applications, where those practical applications are liable to be competitively assailed. Hence, we know generally that sulphate of ammonia is largely utilized in beetroot growing in Germany; but as to the absolute extent, methods, and so forth, outside knowledge is vague and limited. British agriculturists want educating on this question of beetroot cultivation, and the country on that of the encouragement of the establishment of a home sugar industry. This reawakened interest in the question is a matter that the Sulphate of Ammonia Committee must follow up closely; and there must be preparedness on their part with information as to what is done in Germany in the matter of the application of sulphate of ammonia in the cultivation of beet. Though the revival of interest in the subject has not yet had time to make any big headway, there is work to be done in the provision of material with which to stimulate that interest; and the question ought not to be allowed again to disappear from view without a struggle.

Indictment of the Sales of Gas Act.

THE Sales of Gas Act has lately been seriously arraigned as an imperfect instrument for ensuring or certifying the accuracy of gas-meters under the conditions of practical use. The Act has now been in operation upwards of fifty years; but, from the very first, its deficiencies have been recognized, but never made good. In 1860, the year after its introduction, the Astronomer-Royal reported that the omission of provision for the testing of indices rendered the Act nugatory and useless. That was a sweeping condemnation on the point of a single deficiency. Subsequently, a Select Committee reported in favour of amending the Act. Then, ten years later, the Standards Commission reported that the Act should be amended; but as the authorities, despite these recommendations, appeared to think there was no urgency in the matter, twelve years were allowed to elapse before the Board of Trade prepared the draft of an amending Bill. That was 28 years ago! The Act of 1859 has survived all the attacks made upon it; and it still continues its existence with its manifold and manifest imperfections and omissions. It has been a subject of reference of late—in Messrs. Kendrick and Ellery's presidential addresses to the two District Associations of which they are this year the heads; also in our "Correspondence" columns; but more particularly in the article in our columns on Sept. 28 last of Mr. Fred. Coe, of Nottingham, and in the paper, read before the Yorkshire Junior Association, by Mr. P. M'Nab, and published on March 22. The tribute paid (in the discussion) by Mr. Walter Hole to the value and lucidity of this paper is richly deserved; and it must be admitted that it forms one of the most striking indictments of the Act that has yet been made. If the Act was weak in the various years mentioned in the opening lines of this article, how much more is it so now when the conditions under which consumers' meters are called upon to register gas have made such conspicuous flight from the standard conditions prescribed in the Act, and which conditions were thought to be equitable and appropriate enough at the time of their origin.

Meters, of course, are designed and constructed to meet the standard conditions. That is imperative, though the latter do not conform with the conditions under which the meters are called upon to perform their duties. It is, therefore, as has been pointed out, obvious that a meter is not necessarily satisfactory for the fulfilment of its functions under working conditions because it has passed the statutory test, though, as a matter of fact, taking the periodical indications of consumers' accounts as a rough-and-ready test, there is not much to complain about generally as to the constancy of meters, though the examination for stamping has been carried out under circumstances altogether different from those under which the meters are used. That this is so, is a tribute to the excellent range that some well-made meters possess; but, at the same time, there is solid evidence to show that a not altogether negligible percentage of meters would not, tested under the conditions of use, fall within the zone of error permitted by the Act. Pressures now are considerably higher than the standard ones under which meters are tested; and Mr. M'Nab indicates that substantial trouble may arise with wet meters with increased pressures. He also makes reference to the somewhat frequent indifference of dry meters to the passing of the fine streams of gas required by one or two pilot lights. His tests, however, confirm what has been previously pointed out, that under increased pressures the degree of error in registration is more often than not in favour of the consumer, and to the loss of the gas supplier. Among other questions, is that of the difference in temperatures between the test-room and the position in which meters usually work in consumers' houses. But here again the lower temperature of the latter position would be favourable to the consumer rather than to the gas supplier. Nevertheless, there must be some give-and-take in these matters. Standard conditions for testing there must be; and standard conditions cannot be ordered to meet the different degrees of temperature to which meters will afterwards be subject by location and season. There is an almost common agreement that provision should be specifically made in the Act for the testing of meter indices; but though there is not this specific provision, a meter ought not to be stamped unless it registers correctly within the prescribed margin of accuracy. This being so, by inference, if not by precise prescription, the testing of the meter-index should fall within the examiner's duty.

The more, however, that is written on this subject, only emphasizes the fact that the Sales of Gas Act requires revision and amplification, in the latter respect in one way (among others) indicated by Mr. Coe. He says that it is a remarkable fact that the greater number of the official examiners of meters pursue an inadequate practice; and "it is of general importance to all parties concerned, that "official inspectors of gas-meters should follow an adequate "and uniform practice more in accordance with the whole "spirit of the law regarding accuracy in the testing and "stamping of meters." Precision is the object of examination and stamping; and nothing should be left undone to make the examination itself as precise as possible. It is a point which must not be lost sight of.

Bradford and New Carbonizing Systems.

A Sub-Committee of the Bradford Corporation Gas Committee have begun an inquiry into the new carbonizing systems now seeking favour for gas making in place of the older types; and their first report (signed by the Chairman, Mr. H. Geldard, but

bearing unmistakable signs of the assistance of the Gas Engineer, Mr. Charles Wood, in the composition of its technical parts) has been issued. In this report are stated concisely the impressions and particulars collected in Berlin, Cologne, and Munich, with published information as to the British continuous plants. There is no doubt that the deputation returned from their studious wanderings on the Continent fully persuaded that the view of German gas engineers is that horizontal retorts are doomed, and that vertical retorts and chamber settings will represent the survival of the fittest in carbonization plant for gas production. But the deputation have more inquiry to make before they commit themselves to any precise expression of opinion or recommendation. They have been impressed, however, by the Dessau retorts and the Munich chambers in regard, among other points, to the ease of operation, the smallness of the labour requirement, the intermittent labour requirement, and the lowness of labour costs per ton of coal carbonized. By comparison, they place Bradford working in a very humiliating position. With the Dessau verticals in the Berlin retort-houses of the Imperial Continental Gas Association, the production of gas per man employed per shift varies from 270,000 to 310,000 cubic feet. In Bradford, the relative figures are 25,000 cubic feet with hand stoking at Valley Road, and 33,000 cubic feet with machine stoking at Birkshall. The total cost of retort-house labour at Bradford is 2s. 8·98d. per ton of coal carbonized. This looks an ugly figure in contrast with 4d. for the Munich chambers, 5d. for the Berlin verticals, 2·5d. for the new settings at Berlin, and 2·75d. for the St. Helens small trial setting. Respecting the Woodall-Duckham and the Glover-West settings, the views of the deputation will, it is anticipated, be forthcoming in a subsequent report.

First Coke-Oven Gas Scheme in Parliament.

The coke-oven gas scheme for the supply of Little Hulton, to which attention was called in early numbers of the "JOURNAL" this year, is not dead, nor is it even sleeping, through the action of a meeting of ratepayers in rejecting the proposal. As a matter of fact, the project (we think there need be no hesitation in saying now) will receive complete ratification by Parliament; it having already passed investigation by the Local Legislation Committee. The Committee appeared to be somewhat astonished that the Earl of Ellesmere—the owner of an extensive coke-oven plant (some fifty-ovens), carbonizing 200 tons of coal a day, and producing nearly 2¼ million cubic feet of gas—should be prepared to spend £5000 on plant for dealing with a portion of the gas for the supply of the ordinary requirements of the district, and only make out of the deal, under present circumstances, some £150 a year. Of course, one side of the House of Commons is at the present time strongly suspicious of Dukes, Earls, Lords, and such-like, and can only associate them in a common class as land and money grabbers. They have a difficulty in appreciating that men of such rank can have anything but self-centred interests, and can have little thought for those of the people about them. Lord Ellesmere has consideration for the district in which his large coke-oven plant is placed, and he is willing to be of service to the district, not forgetting that this may be the beginning, if successful, of a greater and profitable use of the waste gas from the coke-ovens. That is what the Committee were told; and there is no reason for raising any question upon it. But we see at the back of this scheme the energy and influence of Mr. Ernest Bury, M.Sc., F.C.S., of Little Hulton, the Manager of the Brackley coke-ovens, who counts among the events of his career authorship of his contribution, on the utilization of coke-oven gas, to the proceedings of the Dublin meeting of the Institution of Gas Engineers, at which, it may be remembered, Mr. Charles Hunt was President.

An Economic Question.

With Mr. Bury at the back of this Little Hulton scheme, success may at once be said to be assured. In the discussion on the general subject at the Dublin meeting, Mr. T. Glover said the value of Mr. Bury's paper, and the cognate contributions on that occasion, would not pass away in a day; and both value and nterest are revived upon the presentation to Parliament of this Little Hulton scheme. It is true the scheme (with which Mr. William Newbigging is also identified) is not a large one, as will be seen by our "Notes from Westminster" and the report of the Committee proceedings in our "Parliamentary Intelligence;" but it will represent something more in the utilization of coke-oven gas for town purposes than has been done hitherto, in a small and rather tentative way, in this country. It will be a scheme, subject in every respect to the controlling conditions attaching to ordinary town supply; and there is to be nothing haphazard about it. Illuminating power and calorific power are to be kept above certain standards—in fact, the people of Little Hulton are promised a supply of gas, at a cheap rate, qualitatively equal to the Metropolitan gas supply. We remember well that Mr. Bury's Institution paper constituted a case for serious inquiry as to whether, on economic grounds, the whole or a proportion of the gas obtained from coke-oven plants should not be utilized for general purposes, thus producing a saving in the country's coal supply. But the trouble is there is so much of it produced, and the communities at hand to utilize it are so comparatively small. The surplus not employed for heating the ovens is now used for steam-raising. This is absolute waste. At the Brackley coke-ovens quite one-third of the 2¼ million cubic feet of gas produced per day are utilized in this manner; whereas for the purposes of the neighbouring communities, it is worth considerably more than would be fuel of solid order for steam-raising. Mr. Bury does not suggest that the coke-oven is superior to the retort as a producer of gas; but he looks at the matter solely from the economic side. Metallurgical coke must be produced; and gas is evolved as a residual. What are the best practicable methods of utilizing that gas in the interests of the coal supplies of the country? The demonstration which is to take place at Little Hulton, with Mr. Bury on the spot and interested in it, will be watched with curiosity, with which will be associated a sanguine feeling as to success.

Gas Shares as an Investment.

Though no one having a knowledge of the gas industry would be likely to confuse the grossly over-capitalized, and therefore inevitably foredoomed, creations of professional company promoters with well-established and financially sound gas undertakings, it is evident that the outside public have not invariably shown the discrimination which is necessary even to preserve their capital—let alone increase it. "Once bit, twice shy," is an adage that may apply to investors, as it is said to do to others; and some of those who have put their money into the hopeless gas concerns to which it has of late been our duty to direct so much pointed criticism (as well as others who have read the melancholy accounts of proceedings in the various Courts) may hesitate to try their luck again in the same branch of industry—we intend, of course, in this remark, to refer to the "gas industry," and not the "company promoter's industry." This consideration makes us especially pleased to see in those papers which are perused more particularly by the general public such a signed article as appears in the April number of the "Investor's Chronicle" on "Gas Shares as an Investment." In this, the author expresses the well-grounded opinion that in all probability there is no form of investment that gives such regular and constant dividends as that of gas stock—and at the same time yields such good returns on the outlay; and he thinks the fact that there is not a still greater demand for such securities is probably because gas investments are, to a certain extent, on a different footing from ordinary shares, &c., and with few exceptions they are not quoted on the London Exchange. Taking the Board of Trade returns, it is pointed out in those for the year 1907 there were included 491 companies, with a capital of £86,476,293, and a profit for the twelve months of £4,494,178 which is equal to 5¼ per cent. on the capital employed, or ¼ per cent. more than the previous year. The author says the returns show that "the number of companies in the United Kingdom is 491." But this, of course, is an error, as the returns embrace statutory undertakings, and not many small concerns which do not come under this designation. Emphasis is laid upon the need for studying the particular Act of Parliament which applies to the company in which the investor proposes to take an interest, and some points are indicated which, in conjunction with the usual rules adopted in estimating the merits of a company's stock, it is thought should enable an excellent selection to be made. Some dozen companies are named as possessing merit, both from a speculative and an investment point of view; but, in selecting these, care is taken to make clear—and it is a reservation with which we heartily agree—"that it is impossible to mention all the companies whose shares have merit."

Prospects of Peace in South Wales.

There has been much news from South Wales during the past week, with reference to the negotiations for arriving at a settlement of the coal mining labour troubles. It did not come altogether as a surprise to many people to find that the further meeting of the Conciliation Board which was held last Saturday week at Cardiff, after the intervention of the Board of Trade, was followed by an announcement that a new agreement (to extend over a period of five years) had been formulated, and that the clauses therein were mainly acceptable to both sides. The one debatable point left was with reference to working in abnormal places; and even here, it was said, the differences between the parties had been so narrowed down that nothing was left under this head to jeopardize an ultimate settlement. Under the new agreement, the minimum wage will be increased from 30 per cent. to 35 per cent.; and the equivalent selling price to the new minimum will stand at 12s. 5d. per ton. The maximum of 60 per cent. remains. The men have provisionally agreed to the introduction of overlapping shifts; and the owners no longer insist upon an unrestricted right of introducing double shifts. Such an agreement could, of course, only be arrived at as a result of mutual concessions. The men are withdrawing their claim for payment for small coal; while the owners have given way with reference to their demand that the men should work the extra sixty hours per annum permitted under the Eight Hours Act, and offer to withdraw their claim for accumulated damages, estimated at £250,000, which, it is contended, the men have rendered themselves liable to pay for refusing to work these extra hours since July 1. Subsequent consideration of the matter by the Miners' Federation of Great Britain led that body to express the opinion that the South Wales Executive had struck a good bargain for the workmen; and they advised the acceptance of the owners' offer. In fact, the resolution they arrived at was emphatic—"That we do not think the points of difference are sufficient to justify either a sectional strike in South Wales or a national struggle, with all the tremendous issues involved." The usefulness of this resolution becomes apparent, when it is considered that the acceptance or not of the new agreement will be decided by a ballot of the miners which it has been arranged shall be taken to-morrow (Wednesday). The result will be known by Friday, in time for the meeting of the Conciliation Board; and, if favourable, the new agreement will then be signed by both sides. Meanwhile, operations are being continued at the collieries on day-to-day contracts. It is unthinkable that the men should decline to support their leaders in regard to the agreement that has been arrived at—especially in view of the significant resolution already quoted of the parent organization—which is taken to mean that, should the Welsh miners decide in favour of a stoppage, financial support from the National Federation would not be conceded. Indeed, the confident hope is expressed that the colliers will prove loyal to those who have conducted the negotiations on their behalf.

PERSONAL.

At their meeting last Wednesday the Directors of the Whitworth Vale Gas Company appointed Mr. SAMUEL HILL as bookkeeper and collector, to fill the vacancy caused by the promotion of Mr. SIMEON LORD to the position of Manager of the Company in succession to his father, the late Mr. Edmund Lord.

Mr. HAROLD HORROCKS, who has been a member of the staff at the Heywood Corporation Gas-Works for about eight years, sailed in the s.s. "Ophir" on Friday last for Australia, having secured an appointment in Adelaide with the South Australian Gas Company. Mr. Horrocks, a nephew of Mr. W. Whatmough, will have charge of the carbonizing plant at the Adelaide Gas-Works. Before his departure the staff at the Heywood Gas-Works presented him with an overland travelling trunk.

We learn that Mr. W. H. BENNETT, the Assistant-Engineer of the Dartford Gas Company, is relinquishing this position, having obtained the appointment of Engineer and Manager of the Redhill Gas Company, in succession to Mr. James Paterson, M.A., who, as already announced in the "JOURNAL," will shortly be associated with his father at Cheltenham. The new Manager at Redhill is the son of Mr. C. V. Bennett, of Herne Bay, and was trained under him. He studied Continental gas practice in the Linnaeusstraat Gas-Works, Amsterdam, for eighteen months; and in 1898 he was appointed Assistant-Manager at Yeovil—a position he resigned in 1901 to take that which he now holds at Dartford. He is a grandson of the late Mr. W. H. Bennett, who, as is well known, was for many years Secretary of the British Association of Gas Managers nd the Gas Institute.

GAS STOCK AND SHARE MARKET.

(For Stock and Share List, see p. 57.)

THE Stock Exchange had a busy and buoyant time last week, as if the break caused by the holidays had not been an interruption to business, but a refreshing pause in which to take breath for fresh exertions. The chief point of interest was the Rubber Market, which some little time ago was thought by many to have touched high-water mark, but which now surged more fast and furious than ever. There was not a large attendance the opening day; but the general tone was good, and the tendency was firm all day. Home Governments were steady; Railways were on the rise; and all the rest, except Americans, were in good case. Wednesday was active and firm. Gilt-edged were stronger, and Consols rose $\frac{1}{16}$. Satisfactory traffics gave a fillip to Railways; and the rest in general were fair. In the speculative lines, there was something like a boom. The fortnightly account engaged most attention on Thursday, but still there was no lack of fresh business. Railways showed unabated strength. Home Governments were, however, irregular, and there was more weakness in Americans. The settlement was over on Friday—a light job compared to the previous one, and unproductive of difficulties. In spite of the usual realizing, the tone was pretty firm. Railways continued to prosper, the gilt-edged division were in demand, and the Foreign Market did well. This state of things ruled through Saturday, and Rubber raged rampant to the last. In the Money Market, there was a good call for the Stock Exchange and for the quarter's end at good rates; and discount terms hardened. Business in the Gas Market was only moderate in volume; but the general firmness was excellent, and several quotations made further advances. Some changes will be observed in the Stock and Share List. Notably, the Gaslight and Coke Company's issues are now augmented by the absorption of the West Ham Gas Company's stocks; and in the aggregate they exceed the large figure of £27,000,000. Then, the ordinary shares of Buenos Ayres and River Plate fall out of quotation, in view of amalgamation. Gaslight and Coke ordinary was unchanged at from 103 to 103¾. In the secured issues, the preference made 104 and 105, and the debenture from 80¾ to 81½. South Metropolitan marked 120½ and 121. Commercial 4 per cent. was done at 106, and ditto 3½ per cent. at 103¼. Among the Suburban and Provincial group, Brighton ordinary made 154 and 154½ (a rise of 1), British 45⅛ and 45⅜ *cum div.*, and South Suburban 121 and 122. In the Continental companies, Imperial rose 2, with dealings at from 179½ to 181¼, ditto debenture marked 95, Union from 99 to 100, and Tuscan 9½. Among undertakings in the remoter world, Buenos Ayres changed hands at 15½ special, Bombay part-paid at 5¼, Cape Town preference at 6$\frac{7}{16}$, Monte Video at 12⅞, Primitiva at 7⅝ and 7¾, and ditto preference at 5⅜ and 5½. Other improvements, in stocks which did not change hands, will be found in the list.

ELECTRICITY SUPPLY MEMORANDA.

The "Deadly Products" Slander Again—Policy of Fixed Prices per Lamp not Endorsed—Fire Warnings—Blackening of Metallic Filament Lamps—Chagrin at Felixstowe.

THE question of the "deadly products of the combustion of gas" has cropped up again—this time in "Meteor's" notes in the "Electrical Times." On March 8 we challenged Mr. T. Hesketh, the Electrical Engineer of Folkestone, to explain a statement contained in a circular he had disseminated in Hythe, as to the "deadly products" of the combustion of gas. It appeared in this sentence: "You experience no headaches in the evenings, resulting from the deadly products of combustion, as with gas." Mr. Hesketh has not responded; but it would appear that he has invited "Meteor" to his aid. That gentleman kindly complies in the "Electrical Times" for March 24; and (surely from Mr. Hesketh's point of view) a pretty mess he has made of it—the only defence that he can offer being that, under certain conditions of combustion, something harmful may be produced. Just so. A loose nut, or a flaw in an axle, may produce an omnibus accident. There must be lighting-back of an atmospheric gas-flame (Mr. Hesketh's mentor tells him) before anything deleterious can be given off. But if there is lighting-back in an incandescent burner, light will not be obtained; if there is lighting-back in a gas-heating apparatus of any kind, the apparatus will not perform its functions. This lighting-back condition is not a normal one; but Mr. Hesketh's circular suggests to the uninitiated that the giving off of "deadly products" is a normal accompaniment of the combustion of gas. There is no equivocation about Mr. Hesketh's statement: "You experience [as the result of adopting electric lighting] no headaches in the evenings, resulting from deadly products of combustion, as with gas." "Headaches" and "deadly products" the inhabitants of Hythe are here invited by Mr. Hesketh to infer are inseparable from the combustion of gas under ordinary and normal conditions. We again ask Mr. Hesketh to state what are those "deadly products" that are produced in the evenings by the combustion of gas. We ask that his reply may be as free from ambiguity as his original statement; and not a mere writing round the question, and avoiding the kernel, as has been done by the adept at specious writing, and friend of all electrical engineers who cannot defend themselves—"Meteor."

In defence of Mr. Hesketh, our journalistic friend quotes the case (we do not know whether it is an ancient or a modern one) of a Mrs. Jordan, who died, the doctor "concluded," "from carbon monoxide poisoning, traced to the kitchen stove." This has nothing to do with lighting in the evenings; and, in connection with the use of gas-stoves—bearing in mind the hundreds of thousands there are in daily, almost hourly, use—an isolated instance of this kind only goes to emphasize how safe gas is when used under ordinary (and not abnormal) conditions. The sagacious "Meteor" also quotes from the report of the Home Office Departmental Committee on the Ventilation of Factories and Workshops, to the effect that carbon monoxide is produced "whenever the combustion of gas is *imperfect*, as when a non-luminous flame used for *heating* purposes is allowed to strike-back." There, again, an abnormal condition has to be set up before carbon monoxide is given off—that is a condition precedent to anything harmful happening. "Meteor" must be well aware of the crude and antiquated character of some of the heating appliances used in factories and workshops—frequently of the home-made variety. Both in nature and attendant circumstances, there is no resemblance in these to domestic appliances and conditions of use. Furthermore, in many factories and workshops, the gas employed is of the producer variety, and not the ordinary town-gas supply. We hope that Mr. Hesketh will not further attempt to evade our request for an explanation as to the "deadly products" he insinuates ordinarily arise from the combustion of gas, and occasion headaches in the evenings.

The paper by Messrs. Handcock and Dykes where the fixed-price-per-lamp proposition was revived, and which was originally read before the Institution of Electrical Engineers in London, has been the round of the Local Sections for discussion; and few electrical engineers there are who take kindly to the proposal. So much have the authors been impressed with this fact, and by the reasoning of the opponents, that, at the meeting of the Manchester Local Section, Mr. Handcock, in replying to the discussion, was compelled to admit that the system was not an ideal one, and that there was room for something more satisfactory. That the Chairman of the section (Mr. S. J. Watson) is of opinion that Messrs. Handcock and Dykes have not revived a feasible scheme, is seen by his statement that the solution of the question of tariffs is now as far off as it was fifteen or twenty years ago. Several of the speakers in the discussion detected, without any microscopical examination, certain weaknesses in the scheme. There was no doubt on the part of Mr. R. B. Slacke as to how the small consumer would regard the renewal of the metallic filament lamps. Mr. Slacke understands that the depreciation of these lamps is equal to about 1d. per unit; and, of course, this materially increases the cost of the light. In his opinion, instead of renewing the lamps, the small consumers in many cases would get a new mantle, and return to gas. This view was supported by Mr. P. P. Wheelwright, of Blackburn, who thought that, in cottages and small property, trouble would sooner or later occur owing to the failure or breakage of the lamps. The tenant would then say he could not afford to replace the broken lamps, as they cost him shillings, whereas gas mantles could be obtained for a few pence. Mr. A. G. Cooper also agreed that the cost of the renewal of metallic filament lamps would be a difficult matter. He also saw a difficulty in the expense of connecting up, seeing that for the small consumer it was practically the same as in the case of a large consumer. Doubtful likewise was Mr. C. L. E. Stewart, of Rawtenstall. He finds that in some cottage houses, the yearly gas bill does not amount to 10s.; and, in his judgment, they would not be worth connecting up for electric lighting, in view of the cost of the service. This, however, seems to bear more on free-wiring than fixed prices per lamp. And in connection with the former, Mr. Stewart has no doubt at all that, while free-wiring brings in new consumers, it also brings in bad ones. Bearing upon this, the Chairman stated that he knew considerable sums had been spent on so-called free-wiring systems, with lamentable results to those who found the money. In cases of change of tenancy or ownership, if the installation fell into desuetude, the depreciation was very high. Apart from the want of endorsement of the policy of fixed prices per lamp by electrical engineers generally, there is still also a want of endorsement on the part of small householders in South London.

The Provinces have been having their taste of electrically generated fires as well as London. During the week ending on March 12, two fires of a serious character occurred in Birmingham. One was on the premises of the British Insulated Cable Company, and the other at the millinery shop of Messrs. Bates. The first one broke out at a time when most people are slumbering—2.59 a.m. on the Saturday; and, it is reported, that "several" of the electric wires were found to have been fused. The second fire was at 6.17 on Saturday evening, and was caused by an electric lamp being placed near some artificial flowers made of celluloid and rubber. There were three other cases during Christmas week; and then Chief Officer Tozer called public attention to the danger. But he complains, on the two more recent fires, that no notice whatever is taken of his warnings; and that shopkeepers continue sinning in this way in a lamentable manner. His voice is that of one crying in the wilderness; and he fears that nothing but a disastrous fire, in the midst of the Birmingham people, will shake into them any sense of the seriousness of the danger. The recommendations that he makes are threefold. Electric lamps should be kept several inches away from ignitable goods; wires should be covered with some fire-resisting material; and flimsy materials should be kept a distance from electric lamps, seeing that the latter are so liable to burst. Of course, if shopkeepers will not give heed to these expert monitions, Chief Officer Tozer cannot help it. He has done his duty, and that must suffice. But the neglect comes hard on the fire brigade. Of course, there have been the customary attempts of electrical folks to minimize the statements. These attempts are not in the public interest; but the public recognize in them the struggles of an infuriated interestedness, and treat them with just as much consideration as Chief Officer Tozer's cautions. Now from Birmingham to Manchester. In the "Courier" of the latter city, a correspondent, signing himself "Insurance," has a letter pointing out the necessity of enlisting competent advice, and having all electrical work carried out by a fully qualified man. He thinks that the extensive fires and damage that have already occurred should impress the public as to the necessity of what he counsels. "I have," he remarks, "seen several instances of faulty work which have only just been discovered in time to check a serious conflagration." The public will begin to wonder whether all the statements made in electrical literature regarding electricity should have the literal meaning reversed. Anyway, they have learnt that the words "the safest illuminant" have to be rendered "the most treacherous illuminant;" and all the vapourings of electricians to the contrary will not lessen public confidence in the disastrous demonstrations that have been witnessed.

To the metallic filament lamp have been ascribed all the virtues to which the electrical engineer can lay tongue. But the lamps have their weaknesses; and the public are making their acquaintance. It is well known that the lamps want physical strength, and that there is a marked growing tendency for them to blacken. These matters have been dealt with by Mr. G. Basil Barham, Assoc.M.Inst.E.E., in the "Electrical Times." With the increased supplanting of carbon filaments by metallic filaments, the number of complaints is growing. It is declared by many users that the lamps are more liable to break than they were a year ago. Mr. Barham thinks this is due to familiarity breeding contempt. Whereas formerly the lamps were handled with considerable care—even with reverence—they are now fixed in unsuitable positions, and are more carelessly handled than were their predecessors. As to blackening, undoubtedly in certain brands of lamp, the percentage of blackened bulbs is increasing considerably; and while there are still many lamps which, after lengthy life, are quite clean, "a fair number which have only been in use a few weeks, are showing traces of discoloration." More especially is this so among the high-voltage type of from 40 to 50 candle power. The cause for this must lie either in the method of manufacture or in the materials used—in fact, it would appear there must be more than one cause. It is thought that the phenomenon is generally produced by either the presence of carbon in the filament, or of some volatile compound of tungsten remaining with the metal in the filament, or to the occlusion of carbon or volatile metallic gases from the leading-in wires, anchors, or supports. But the carbon appears to be the predominant cause of the trouble. If it is not entirely eliminated, the lamp is certain to blacken in time; and if it is removed, and the operation is not carried out with the utmost care, the filament is liable to fail prematurely. With the concluding words of Mr. Barham's article, there will be agreement. The problems that beset the metallic filament lampmaker are indeed many; and this question of discoloration is one of the most difficult he has to overcome.

Felixstowe is enjoying the periodical sensation of a contest for membership of the District Council; and the opportunity has been taken, apparently by the electrical interests, to push gas and electric lighting forward as a topic of public interest. We do not think the electricity folk will gain much by their temerity. But when one is smarting under an ignominious defeat, there is perhaps some little excuse for rashness. It may be remembered that last year the Gas Company obtained the lighting of the Sea Pavilion; and then upon this they secured a new contract with the Council for street lighting for a term of three years commencing with Jan. 1 last. These successes are the cause; electrical annoyance the effect. The troubles of the electricity concern at Felixstowe (which have resulted in it being vested in the District Council, who find the capital on which the Company pay interest) have given electricity a bad name in the town. But a curious ratepayer at the election meeting at which candidates were selected, asked one of them why, if the electric light concern belonged to the ratepayers, the streets were lighted by the Gas Company. The ratepayer had his quietus in the simple answer and fact that last year the electric light went out twenty times; and the Council must consider efficiency. If all Councils prudently considered efficiency, electric lighting for the streets would be doomed. After this meeting Mr. Napier Prentice issued a singular document, in which he, eschewing altogether the question of efficiency, endeavours to show that the Council, by throwing out gas and establishing electricity in the public lamps in 1903, would have made a decent profit on the transaction. But there are no details granted to enable critics to judge of the accuracy of his statements, nor whether the ratepayers would have been better served as a result of the change. There is good reason for grave doubts on the point of efficiency. If Mr. Prentice wants people to place any credence in his statements connected with a discredited undertaking, he must not be so economical in the information that he affords. A further reason for doubt as to the Council deriving profit by further electrical speculation in the

manner that would have delighted Mr. Prentice's heart, is found in the Council's electricity fund account for the year ending March 30 last. The amount received by the Council from the Electricity Company (6 per cent. on the capital advanced) was £747 12s. 4d.; and interest on the unexpended balances of loans placed on deposit was £25. These two sums make £772 12s. 4d. In respect of this capital, the Council had to pay £483 19s. 5d. interest, and in repayment of principal £382 16s. 5d.—together, £866 15s. 10d. Therefore the loss for the year which has had to be transferred to the district fund is £94 3s. 6d. This, and twenty failures in a year! Who is surprised that the Council have hardened their hearts against electricity? Perhaps, too, they know that Mr. Prentice's specious-looking figures do not tell the whole tale as to the relative illuminating efficiency of gas and electricity for the cost.

HIGH-PRESSURE DISTRIBUTION IN PARIS.

About six months ago, Mr. W. R. Herring, the Chief Engineer and Manager to the Edinburgh and Leith Gas Commissioners, had a visit from MM. Gustave Cocu and A. Chibeault, two members of the technical staff of the Paris Gas Company (the latter being the Chief Distributing Engineer), whose object was to make a thorough investigation of the distributing system, more particularly with regard to the high-pressure main encircling the district, and, by means of underground governors, feeding gas not only into the heart of the area of supply through the existing system, but also, through branches taken from the main, to new districts developing in the outskirts. In order to assist his visitors in their investigations, Mr. Herring sent them a few weeks later one of the most recent official maps of Edinburgh, Leith, Portobello, and the suburbs, marked with lines showing the high-pressure mains conveying gas into the holders distributed throughout the city, from which supplies are taken by means of a governor or controller to the ordinary supply system, and with other lines indicating the lesser series of pipes containing the ordinary consumer's pressure. He also sent several drawings furnishing important particulars bearing upon the object of the visit. We now learn from him that the details above referred to were communicated to two of the Engineers (MM. Cramblay and Charuit) of the Société d'Eclairage, Chauffage, et Force Motrice of Paris, who supply with gas a large number of the suburban districts; and that a short time since he received a letter from the Secretary of the Company to the effect that the gentlemen named, the latter of whom is the Chief Distributing Engineer, would call upon him to obtain further information in regard to the advantages attending the Edinburgh system of high-pressure distribution, with the view of something similar being adopted by the Company. The system, it may be remembered, is fully described in Mr. Herring's account (in book-form) of the construction and equipment of the Granton Gas-Works.

Cause of Blue Prints Fading.

To those engineers and managers who have been inconvenienced by the fading of their blue prints, the following observations of Mr. G. G. Merry, contained in a letter to "Engineering Record," will probably be of interest. If prints are made on old paper, both the background and the lines will readily fade, because partial chemical change takes place previous to printing. It is very important that only fresh-coated paper be used. I never use paper that has been on hand for more than five days. The most rapid printing papers should be avoided, as the excess of ammonium salts used in coating this paper is difficult to remove by washing, and the continued chemical action causes fading. The best results are obtained from the slower printing papers. Insufficient washing causes many blue prints to fade. Only by washing a print for at least ten minutes in clear running water can all the salts be removed. If the paper is too porous, the coating penetrates too deeply into the paper; and since all the salts cannot be washed out, fading will follow. The coating should be only surface deep; and this can be realized with a non-porous paper only. Transparent or semi-transparent inks will promote fading, because the light which passes through the lines causes premature chemical action. Only the best India ink should be used on the tracing. Blue prints should be neither over nor under printed. If the former, the light penetrates the ink; if the latter, the chemical action is not complete. A print should, however, be exposed just as long as possible. After washing the print thoroughly, Mr. Merry always treats it with a chemical solution, and then washes it thoroughly again. In this way only is he able to get satisfactory results. He considers there is no economy in engineers making their own blue prints where the amount of work is small; and he thinks it more satisfactory to hand the job over to a specialist.

The annual dinner of the Association of Engineers-in-Charge will take place in the King's Hall at the Holborn Restaurant next Saturday. Tickets for the dinner, at which the President (Mr. Henry Adams, M.Inst.C.E., M.Inst.M.E.) will take the chair, with the Lord Mayor and the Sheriffs of the Corporation of London as the guests of the evening, can be obtained by addressing the Hon. Secretary at St. Bride's Institute, E.C.

NOTES FROM WESTMINSTER.

After the brief Easter break—brief because the House of Commons is vehemently busy on a scheme for, if possible, rendering the House of Lords largely ineffective as a legislative body—there was a little show last week at preserving the continuity of Private Bill work by the Local Legislation Committee assembling on Wednesday and Thursday, and giving consideration to the Little Hulton District Council Bill, and afterwards adjourning until to-morrow. The Referees' Court of the Lower House also held a sitting on Thursday, and disposed of various applications for *locus*. In the present week, we are promised more activity, and a larger degree of interest. To-day, the Duke of Northumberland will preside over a Committee, whose group of measures contains the Matlock Bath Bill. Mr. Mooney, who rendered excellent service last year as Chairman of a Committee, will take headship of one who will have before them, among other measures, the Glasgow Consolidation Bill and the Wishaw Burgh Extension Bill. Next day, in addition to the Local Legislation Committee, a Committee (of which the Chairman will be Mr. Armitage) will commence the consideration of a group of measures, embracing the two opposing Mallow Gas Bills, the Tipperary Gas Bill, and the Slough and South Hants Water Bills. The Mallow and Tipperary measures were originally in the group allocated to Mr. Arthur Stanley's Committee, who considered the Brighton and Hove Gas Bill. But surpassing all else in interest will be the beginning, on Thursday, of the contest over the Standard Burner Bills; the Chairman of the Committee being Lord Ritchie, of Dunfermline. The same day a Committee with the Earl of Kintore as Chairman will set to work on a group of measures comprising, among others, the Abertillery and District Water Board Bill and the Cambridge Water Bill. Altogether, it should be a fairly busy week, and one full of interest.

Coke-Oven Gas Project. It had been thought that, in view of the ratepayers of Little Hulton having, in public meeting assembled, rejected the coke-oven gas-supply scheme outlined in a Bill the District Council had laid before Parliament, that the whole proposal was as good as dead. The thought was not only premature, but it was wrong. The Bill came before the Local Legislation Committee last Wednesday and Thursday; and Counsel (Mr. Jeeves), Mr. Ernest Bury, who is the Manager of Lord Ellesmere's coke-works, and Mr. William Newbigging between them convinced Sir Francis Leyland-Barrett and his colleagues that the project was sound and practicable. Briefly the plan is to supply to the district gas from the Earl of Ellesmere's coke-ovens, through the distribution system to be made over to the District Council for £7500 (without charge for severance or prospective value) by the Salford Corporation. It was proposed originally in the Bill to purchase the portion of the distribution system in part of the Council's area of the Farnworth and Kearsley Gas Company. But an agreement has not been effected with the latter; and the Council have therefore removed this part of the scheme from the measure, in the hope that time will yield an arrangement. The coke-oven gas scheme, and the terms of supply, were fully explained in the "Journal" for Feb. 1, p. 291. The reported evidence on the scheme of Mr. Bury and Mr. Newbigging will be found more than ordinarily interesting, as it is the first project for the general distribution of coke-oven gas to come before Parliament. Technical details regarding the coke-oven plant were given by Mr. Bury; and it appears that in the fifty coke-ovens constituting the Brackley plant, some 200 tons of coal a day are carbonized, from which are produced 2,200,000 cubic feet of gas of a composition, illuminating power, and calorific value equal to the gas distributed in the Metropolitan area. What more can Little Hulton want? It was clearly shown by the evidence that in this matter the Earl of Ellesmere is animated more by the welfare of the district than by his own profit. Compared with the production of coke-oven gas, the requirements of the place are small—only about 13 millions a year being needed in the area to be first served. This will come out of the one-third part of the gas production at present used underneath the boilers at the coke-oven works; the remaining two-thirds, by the way, being employed for heating the coking chambers. The Earl is charging 9d. per 1000 cubic feet for the gas; so that the revenue will only amount to about £500 a year, of which some £150 will represent profit, though his Lordship will have to spend £5000 on the provision of the necessary works. The profit is not much, having regard to this capital expenditure and the responsibilities and obligations that will repose on the Earl. The future may make the scheme more lucrative for him if there is an additional demand from other areas; but anyway it is quite plain that his Lordship is not pressing the matter in any way. The Committee passed the preamble of the Bill. But they desired that it should be made abundantly clear that no statutory authority is conferred on the Earl of Ellesmere; and they further ordered the agreement with Salford to be scheduled to the Bill.

Welsh Water. Questions of *locus* are often somewhat difficult to decide; but in the matter of the applications of the Neath Rural District Council and the Barry Urban District Council to be allowed a hearing on the Pontypridd Water Company's Bill, not much trouble fell upon Mr. J. H. Whitley and his colleagues of the Referees' Court, in deciding that the indulgence that is now being asked for by the Water Company will not in any way prejudicially affect the

petitioners. The Company obtained powers in 1908 to construct water-works and a reservoir in the neighbourhood of a reservoir owned by the Neath Rural District Council; the Act giving them two years within which to make a substantial commencement with the works. The Company are asking for an extension of this time. The Neath Council fear that there is no intention on the part of the Company to construct the works; and if they do construct them, water will be taken from the immediate neighbourhood of their own reservoir, and they will be injuriously affected. The Council were not granted what they desired; and the same result followed the application of the Barry authority. This body also asked to be allowed a hearing against the Pontypridd and Rhondda Joint Water Board Bill, under which the promoting authorities are proposing to purchase by agreement the undertaking of the Pontypridd Water Company. The Barry Council requested *locus* on the ground that the gathering area which would supply the reservoir under the Bill was the only source on which they could rely to supply their own growing population. Inasmuch as the promoters are not asking for any authority to enlarge the existing works and powers of the Company, *locus* was again disallowed. The Neath Rural Council were more fortunate in obtaining the right to be heard on the Mountain Ash Water Bill.

GAS-WORKS' BOOK-KEEPING.*

THE little volume before us has been compiled by Herr F. Greineder, the Works' Engineer of the Cologne Gas-Works, with the object of systematizing the keeping of books and accounts of the working operations of a gas-works, as distinct from the ordinary business book-keeping of a gas undertaking. The system may be followed either primarily—for facilitating calculations of prime cost—or for checking the routine working and periodical results. The necessity for such accounts for the purpose of controlling the operations and procedure in industrial undertakings, has become more clearly recognized in Germany during the recent period of depression in business. In regard to gas-works, Mr. E. Körting, the General Manager of the Berlin works of the Imperial Continental Gas Association, has on more than one occasion drawn attention to the imperative need of securing the light which careful book-keeping affords on the working of a gas-works. Herr Greineder says that doubtless there are good systems of works' book-keeping in use at many gas-works; but, unfortunately, none of the methods followed have hitherto been published. Hence his effort, made through the present little volume, to describe a suitable system.

Allowing for the necessary differences in procedure on German and English gas-works, and for differences in the way of conducting business transactions in the two countries, we think Herr Greineder has fulfilled his object very satisfactorily. He first deals with the fundamental principles which must underlie any system of works' book-keeping, and then passes on to the manner in which the accounts should be separated or classed, the subdivision of outgoings, and the establishment of subsidiary accounts, such as for the water or electric current required on the works. He next proceeds to the determination of expenditure under the heads of (1) wages, (2) materials, (3) improvements, (4) plant. After this, he shows how a general summary or abstract of the works' accounts should be drawn up from the various detailed accounts. Tables and plates are given to illustrate the mode of keeping the working accounts or books of a gas-works according to the author's system.

* "Betriebsbuchführung für Gaswerksbetriebe. Darstellung der Methode einer Betriebsbuchführung zum Zwecke der Wirtschaftskontrolle in Gaswerksbetrieben als Beispiel durchgeführt für einen grösseren Gaswerksbetrieb." Von Dipl.-Ing. Friedrich Greineder, Betriebsingenieur der Gaswerke Köln a/Rh. Munich and Berlin: R. Oldenbourg; 1910.

Labour Co-Partnership Association.—At the annual meeting of the Association, to be held at the Mansion House on the 15th inst., under the presidency of Mr. D. J. Shackleton, M.P. (who will be supported, among others, by Mr. Corbet Woodall, the President-Elect of the Association), Mr. L. W. S. Rostron, the author of "The Powers of Charge of the Metropolitan Gas Companies," and a member of the London County Council, will read a paper entitled "The Progress of Co-Partnership." It will follow Mr. Shackleton's Presidential Address.

The Havard Coal-Meter.—We learn from the Engineering Supplement to "The Times" that a device has been brought out by the O. D. Havard Company, of Scranton (Pa.), for measuring the quantity of coal or any other granular material, such as sand, gravel, &c., without weighing. It is intended to be placed in a vertical pipe such as the outlet from an overhead bin; and the action of the material in descending revolves a very long pitch propeller wheel projecting upward in the centre of the pipe. Through bevel and worm gears the revolutions of the propeller wheel are recorded on a counter on the outside of the pipe. The meters are calibrated to within 1 per cent. of scale weight; and in boiler-rooms, where they have been found valuable in giving a continuous measure of the fuel consumed, they can be calibrated to give a correction for the moisture in the coal, so that the engineer may know more accurately even than by weighing with scales how much coal is being burnt.

PARIS GAS-WORKS EXTENSIONS.

An Important Scheme.

THERE was recently submitted to the Paris Municipal Council, by the Prefect of the Seine, a report furnishing details of a scheme of reconstruction and extension of the gas-works of the city at an estimated cost of 180,000,000 frs. (£7,200,000). An abstract of the report has been given in the "Journal de l'Eclairage au Gaz et à l'Electricité," and from it we take the following particulars.

It should be stated at the outset that, on the suggestion of the Paris Gas Company, the Municipality have since 1908 undertaken, as a matter of urgency, some important extension works involving an outlay of 47,000,000 frs. (£1,880,000), which will be met to the extent of 38,000,000 frs. (£1,520,000) out of a loan which has been submitted for the approval of Parliament. As soon as the new Company took possession of the property, they laid before the Administration a scheme which they considered should be carried out in order to meet the demands upon the works; for though the severance of the suburban communes in 1906 left the Company with a margin of productive power to the extent of 38 million cubic metres, or about 1342 million cubic feet, the reduction in the price of gas from 30c. to 20c. per cubic metre—*i.e.*, from 6s. 9d. to 4s. 6d. per 1000 cubic feet—enabled the Company to recover in two years the consequent loss of consumption, and the increase subsequently continued in a remarkable degree. This great demand could only be met by taxing the works to their utmost capacity, and utilizing reserves which were necessary for meeting emergencies. Had it not been for the very mild winter of 1908-9, these reserves would in all probability have been insufficient; and the member of the Municipal Council who had charge of the report (M. Dausset) clearly pointed out that the 47,000,000 frs. scheme was only an instalment of the complete programme. While the old Company kept a reserve exceeding the consumption by 15 per cent., their successors at one time had only 3 per cent., which, of course, was altogether inadequate.

When the loan of 38,000,000 frs. had been sanctioned, it was decided to commence the works without delay. Accordingly, new plant was put in at the Landy station equal to a production of rather more than 6 million cubic feet of gas per day; and two additional retort-houses of like capacity, as well as two gasholders, each capable of storing 5½ million cubic feet of gas, are in course of erection. The excavations for a third gasholder of the same size are in progress; and one of the gasholders at the Clichy station has now been telescoped, and its capacity raised thereby from 1 million to nearly 2½ million cubic feet. The purifying plant there and also at La Villette has been improved and enlarged; while new purifiers have been installed and the tar-distilling plant has been augmented at Ivry. Concurrently with these extensions at the works, the distributing plant has been extended. A 40-inch main has been laid from the Landy station into Paris, where it branches off in two directions, one of them being the well-known Place de la République. The other portion of the main leads into one 28 inches in diameter. A main is now being laid from the Landy station to the Place de la Concorde. The gasholders at this station and at La Villette have been connected; and those at Clichy are to be similarly dealt with. The quality of the gas has been improved by adopting more up-to-date processes of purification, notably by the introduction of naphthalene washers.

The series of works just described were undertaken to satisfy immediate requirements. A much more extensive scheme, however, remains to be carried out, not only to meet future increases in consumption, but also to perfect the manufacturing operations. This scheme has been carefully considered by the responsible officials of the Gas Company, who have had the gratification of seeing their proposals approved and adopted by the Prefect of the Seine, as evidenced by the report submitted to the Municipal Council. This report comprises a general programme of works to be carried out, during a period of ten years, with the object of increasing the productive capacity of the Landy, Clichy, and La Villette works, the extension and improvement of the plant, the construction of large additional works in the south-east of Paris, and the closing-down of six of those now existing which are out of date, and have for some time been marked for demolition. The reason for the preparation of this extensive scheme will be apparent from the following figures showing the progressive increase which has taken place in the consumption of gas in the period extending from 1902 to the end of last year:—

Year.	Consumption. Cubic Metres.	Increase. Per Cent.	Number of Consumers.
1902	289,538,283	—	454,651
1903*	314,039,558	8·42	489,185
1904	330,600,601	8·44	512,728
1905	344,157,847	4·70	536,626
1906	352,558,335	2·41	555,720
1907	371,156,556	5·27	583,343
1908	387,502,562	4·40	608,149
1909	408,902,303	5·52	630,104

* Price reduced from 6s. 9d. to 4s. 6d. per 1000 cubic feet.

It is unnecessary to convert all the figures showing the consumption of gas; it is sufficient to say that in 1902 it was about 10,236 million cubic feet, and last year about 14,438 millions.

Taking into account the progress since 1903, the Prefect of the Seine estimates that in 1920 the consumption of gas will have reached 550 million cubic metres, or about 19,500 million cubic

feet; and this is the figure given in the report. On this assumption, the productive capacity of the works should be equal to the maximum consumption—*i.e.*, on the 24th and 25th of December—with a surplus of 10 per cent. for contingencies. The capacity of the existing works does not very greatly exceed 63½ million cubic feet per day; and it will be increased to the extent of rather more than 12¼ millions by the end of the current year, when the new retort-houses at the Landy station will be finished. The necessary supplement will have to be obtained by further additions there and at La Villette. The first-named station can be doubled in extent by the utilization of some contiguous ground having a superficial area of close upon 114 acres, or nearly equal to that of the station itself, from which it is separated only by a main road. As it was acquired originally by the old Gas Company, it is now the property of the City. Upon it, therefore, can be erected, as in the existing station, four retort-houses having a total productive capacity of nearly 25 million cubic feet. The new works will stand alongside the St. Denis Canal, and be connected directly with it by a travelling crane to facilitate the unloading of barges; while by means of the adjoining works they will be in communication with the Northern Railway system.

The Company also contemplate the augmentation of the productive capacity of the works at La Villette. They are connected with three lines of railway—the Northern, the Eastern, and the Girdle—stand on an area about 52 acres in extent, and have a productive capacity of about 14 million cubic feet per day. In place of the existing horizontal retorts, heated by ordinary furnaces, and the buildings containing them, which are in a bad condition, there will be constructed powerful settings of modern type. In this way, their capacity will be raised from 14 to nearly 16 million cubic feet per day. Finally, in order to modernize the station, which is well situated, it is necessary to reconstruct the exhauster and purifier houses, which are altogether out of date, overhaul and repair the mains, instal plant for the mechanical unloading of the colliers, and telescope some of the gasholders which are of insufficient capacity.

The Prefect next considers the question of closing-down the works at Passy, Boulogne-sur-Seine, Alfortville, Ivry, St. Mandé, and Vaugirard; and he finally decides on the advisability of doing this, as well as of putting up large works in the south-east of Paris. The sale of the sites of the works named would, he estimates, produce at least 20,000,000 frs. (£800,000), which would go towards a reduction of the 180,000,000 frs. required for carrying out the complete scheme. The advantages attending the construction of these works are thus summarized: The maximum capacity of the works proposed to be closed being about 24 million cubic feet per day, the question might be asked whether their replacement by a single station equipped on modern lines would really be advantageous; the cost of such a station, inclusive of land, buildings, plant, mains, &c., being estimated at 56,500,000 frs. (£2,260,000). To this it might be answered that the substitution of modern plant in the new works would, according to the estimates prepared for the Gas Company, result in a saving of from 1·46 c. to 1·96 c. per cubic metre, equivalent to from 4d. to 5¼d. per 1000 cubic feet, in working costs, or about 245,000 frs. (£9800) per annum, supposing retort-settings similar to those at the Landy station were employed. Under these conditions, which represent only the minimum of the economies realizable by the change, M. Lauriol, the Chief Engineer of the Municipal Gas Department, acknowledges that, after allowing for the sale of the sites and other matters, the figures would about balance themselves.

The proposed new station is intended to serve more particularly the left bank of the Seine. Its situation will certainly be less favourable there than on the north of the river for the delivery of coal by boat or by rail. But it is considered advisable not to locate all the centres of production in the same district; and therefore it will be a good thing to have on either side of the river works serving approximately the portions of the city in which they stand. The Prefect of the Seine is of opinion that the new station could be ready by 1915; but he points out that the Gas Company ought before 1912 to have the necessary authority and funds for the acquisition of the land. The proposed works will occupy a site 25 acres larger than that of the Landy station and the adjacent area, which it is proposed to cover. At the outset, the production could be limited to about 17½ million cubic feet per day; but by 1922 it could easily be brought up to nearly 25 millions, and later on to a similar extent. The new station would comprise tar and products works, and there would be spacious coal-storage grounds. With regard to the existing products works at La Villette, they have to deal with all the tar produced at the various stations, with consequent attendant heavy expense for its transport. Moreover, as with the introduction of modern appliances in the existing or the proposed works the production of tar must increase, it has been necessary to give some attention to the provision of additional plant. With the exception of the products works at Clichy, which are fairly modern, all the others which are to be thrown out of use will be replaced by entirely new ones at La Villette, and they will work up the ammoniacal liquor produced there as well as at Le Landy and the adjoining new works. Eventually tar and chemical products works will be erected in the new south-east station. After these arrangements have been completed, only the Clichy works will have to send their tar to other products works for distillation. From all the others it will be conveyed direct into the works adjoining those in which it is produced. When the Villette station is reconstructed, the fire-brick works will be dismantled. The portion of the scheme just outlined is estimated to entail an expenditure of about 9,500,000 frs. (£380,000).

In the report under notice, attention is called to the fact that the Gas Company have no railway rolling stock, whereas this is urgently needed for properly carrying on gas-works. In order to avoid hand labour in getting the coal into the hoppers conveying it to its destination, it is necessary to have railway trucks which discharge directly from the bottom by the simple opening of a trap-door. The railway companies, however, decline to build such trucks, on the ground that they would be of use in only one industry. Moreover, it is very difficult to construct viaducts and provide hoppers which would be suitable for waggons of different types. It is pointed out that in large modern gas-works, especially those in England and Germany, the coal-waggons are adapted to the overhead railways and existing hoppers; thereby ensuring the economic discharge of coal without resorting to manual labour. The Company consider the provision of such waggons necessary for gas-works of the magnitude of those which for many years will be in operation round Paris. Indeed, those at Le Landy have already been arranged for taking in trucks of this type. The works which will be erected on the at present unoccupied site contiguous to this station will, of course, be laid out for receiving such waggons; the Villette and Clichy stations are to be altered and improved; while the south-east station will be entirely new. It seems only in keeping, therefore, to have a modern equipment of rolling stock running from the mines right into the works. Besides, the adoption of 40-ton waggons for the transport of coal commends itself from the fact that it would allow of the minimum of labour being employed in the works, and enable a special transport tariff to be arranged. Each train running over the companies' systems could be composed of 16 waggons; and allowing four to be kept in reserve for repairs, 20 waggons per train might be reckoned for. Assuming twelve trains running (six each way), 240 waggons would be required. Five of the trains could cope with the traffic from the mines to the five gas-works, and a double train would be available for conveying coal from one works to another, or coke from them to the stores in Paris.

The approximate cost of the works previously described may be stated as follows:—

	Francs.		Sterling.
Altering the Clichy and La Villette stations	25,500,000	..	£1,020,000
New works at Le Landy and in the south-east of Paris	110,000,000	..	4,400,000
Land for the latter works	10,000,000	..	400,000
Tar, chemical products, and fire-brick works	9,500,000	..	380,000
Railway rolling stock	5,000,000	..	200,000
Reserve to meet unforeseen expenses	20,000,000	..	800,000
Total	180,000,000	..	£7,200,000

As already mentioned, the total cost of the scheme will be reduced by the proceeds from the sale of the plant and sites of the dismantled works, which it is thought may be reasonably estimated at 20,000,000 frs.—equal to the sum reserved to meet contingencies. This would bring down the total to 160,000,000 frs. (£6,400,000).

The foregoing is a summary of the report which the Prefect of the Seine has submitted to the Municipal Council of Paris. As mentioned at the outset, the principle of the scheme has been approved, and the Gas Company, who will carry it out, will have to submit to the Administration every year the particular portions they purpose undertaking.

The discussion on the "Measurement of Light and Illumination" will be continued before the Illuminating Engineering Society at their meeting on Thursday of next week, the 14th inst., at the Society of Arts rooms, John Street, Adelphi. The chair will be taken, at 8 p.m., by Professor Sylvanus P. Thompson, F.R.S.

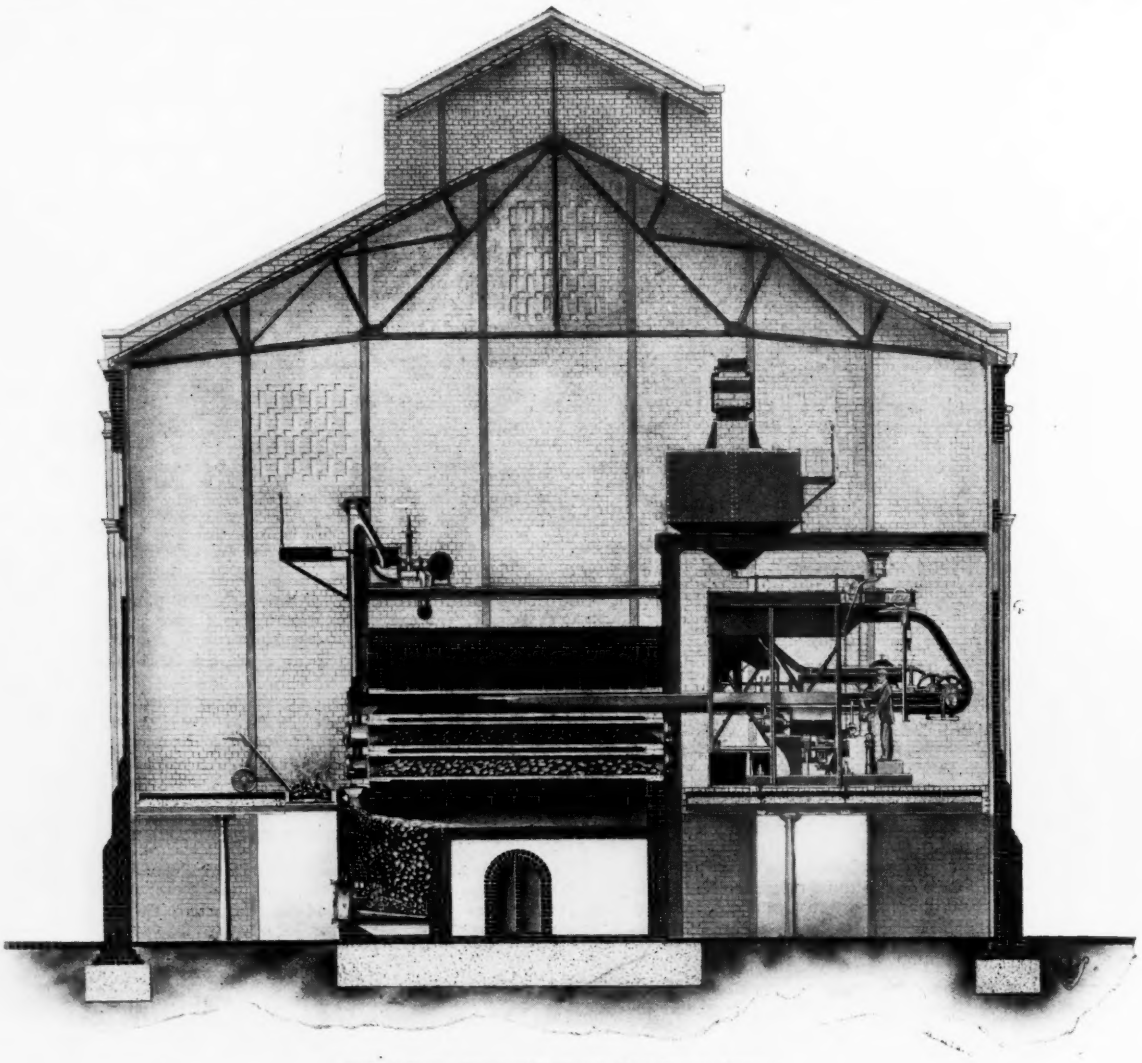
Last night the Society of Engineers had presented to them a paper by Mr. Percy G. Scott, Assoc.M.Inst.C.E., describing the Moulheim Water-Works. The following is a synopsis of the paper: Outline of five schemes prior to theo ne described —survey operations—the reservoir and its storage capacity—head-works, comprising dam or earth embankment, outlet sluice, and waste weir—service cisterns—distribution system—water-rates—loans—abstract of costs—expenses of maintenance.

The owner of a name well known to many gas engineers and managers—M. Louis Denayrouze—has lately passed away. He was a man of varied talents; having in turns devoted his attention to literature, politics, and engineering. It is on account of his connection with the last-named profession that his death calls for notice in these columns. In the early days of electric lighting, he was attracted by it; but he subsequently devoted himself to improving the other systems of lighting—by gas, alcohol, petroleum, and benzol. Between 1894 and 1896 his burner was several times described in the "JOURNAL." He was admitted a member of the Société Technique du Gaz en France in 1883. In 1896, he read a paper on high-power incandescent lighting; in the following year, he described his burner; and in 1904, he reviewed the progress of incandescent lighting. His last communication to the Society was made at the meeting held in Paris in 1908; and it was on the subject of the use of coal-tar hydrocarbons for the above-named purpose.

WEST'S NEW POWER-STOKER FOR HORIZONTAL RETORTS.

As the pen is taken up to describe to our readers the new power-stoker with which the name of West is identified, it is impossible to restrain a little retrospection from the standpoint of present conditions. These are times when the eyes of carbonizers for the production of gas for town purposes are fixed intently on vertical retorts, but belief in the future of the new system of carbonization varies with different men in a somewhat markedly wide degree. There are those who think that, operated according to the modern approved methods, the horizontal retort, all things considered, will not be beaten out of the field by retorts set vertically; and there are others who are of the converse opinion. Whatever the present view—views of the kind can only secure their affirmation or negation by time—this is positive, that there cannot be any extraordinarily extensive transformation of the type of carbonizing plant for some years to come. What transformation there is must be within the limits of extension work and complete conversion of settings. There are few gas-works in which there are not houses accommodating horizontal retorts; and the number of settings that are to be found in those houses that, by the renewal only of the portions within the arches and above the combustion chambers, will continue to render good service for a number of years to come are—we might almost say—countless. This being so, their operation in the most economical way, and in manner that shall yield the most generous results, are conditions devoutly desired by every gas manager. That is the position from which retrospection is made.

From the old days at Maidstone, when manual stoking-machines were first introduced by Mr. John West, there has never been any lack of ingenuity in enabling West's Gas Improvement Company, Limited, to not only keep pace with the times and the requirements, but it must be—in fact, it is universally—conceded that, through that Company's chief and founder, there have been given to the gas industry some considerable and valuable



Retort-House fitted with West's New Power-Stoker.

advances in mechanical operation of retort-houses. The power machines that followed the original manual ones have been greatly improved from time to time, and adapted to most conditions of works. The combination machine that discharged and charged from one platform, and the machine when lighter charges were the vogue in which the scoop was used as a ram, were inventions that were in keeping with the spirit of the times. In these advances, it has been seen that the firm have never allowed self-interest to interfere with their compliance with altered demands. Combination machines, the discharging and charging machines working from one side of the bench only, are the tangible recognitions of changing tendencies. The gas engineer felt that the extent of coal handling plant and hoppers, charging and drawing machines and coke-conveyors on both sides of a bench, represented a heavy capital outlay and also unnecessary working cost. Mr. John West met their views with the new machines. Upon this came the revised methods of working horizontal retorts—methods that are extensively approved by the professional men of the industry. But the machines of the old types are not convenient for, or suitable to, the heavier charge. There was a difficulty to be overcome; and there has been success in the machine now being described. Discharging and charging in one operation, and by a machine that will carry into the retort a heavy charge of coal, are the ends aimed at and achieved. It constitutes the latest evidence of the firm's desire—and not only desire, but ability—to conform with the progressive aims in the field of carbonization.

The new machine is designed for the discharging and charging of retorts of the usual length of 20 feet from one side of the bench; the re-charge being of weight suitable to the capacity of the retort, and the length of time allotted to complete its carbonization. By the heavier charge and the longer duration of carbonization, there are realized the advantages, subscribed to from many quarters, of an improved quantitative and qualitative yield of gas, reduction of sulphur compounds and naphthalene, and improved coke, with the additional advantage of decreased wear and tear of plant. The new power-stoker does the work which formerly necessitated employing four machines, with their

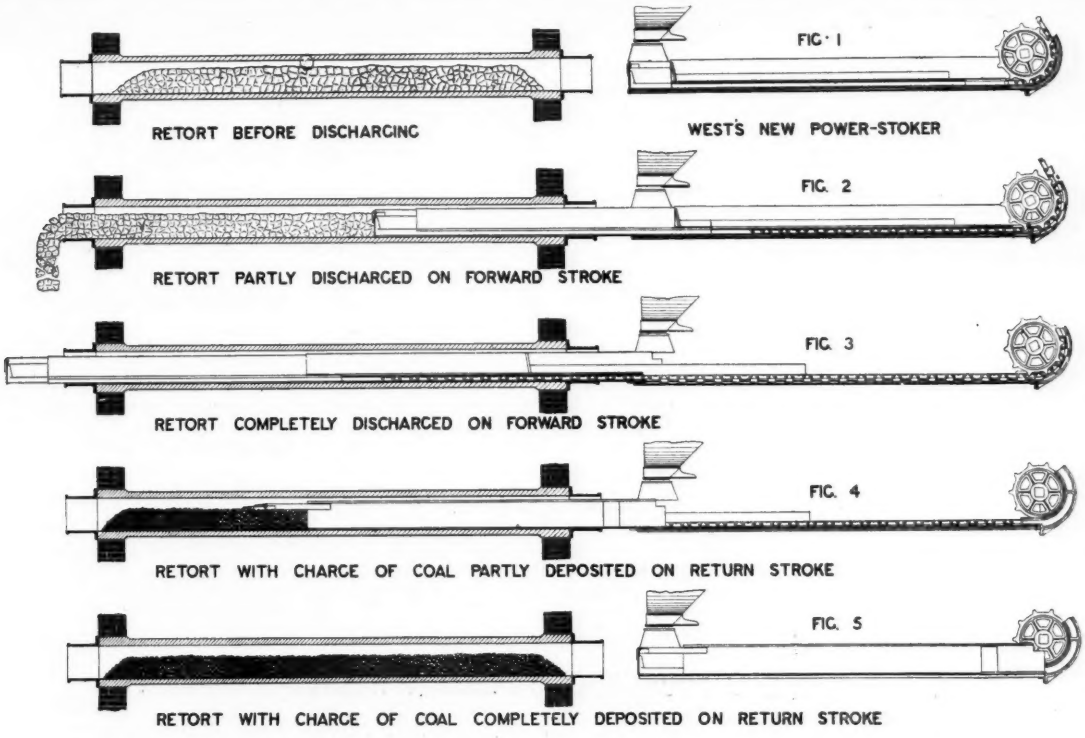


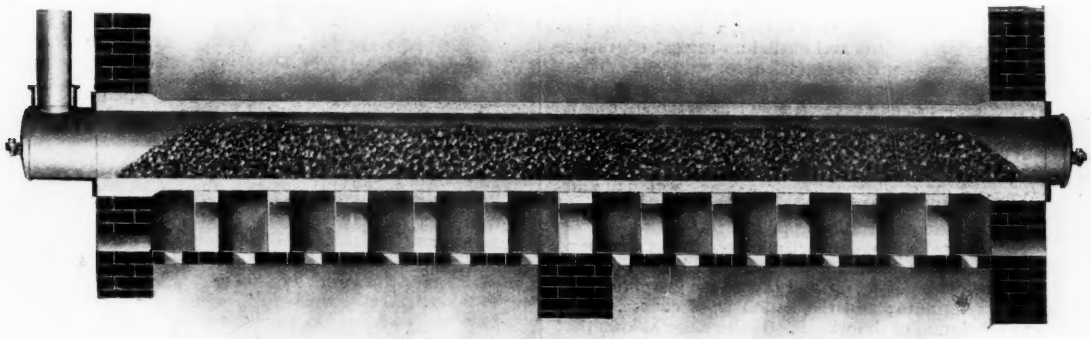
FIG. 1
RETORT BEFORE DISCHARGING
WEST'S NEW POWER-STOKER
FIG. 2
RETORT PARTLY DISCHARGED ON FORWARD STROKE
FIG. 3
RETORT COMPLETELY DISCHARGED ON FORWARD STROKE
FIG. 4
RETORT WITH CHARGE OF COAL PARTLY DEPOSITED ON RETURN STROKE
FIG. 5
RETORT WITH CHARGE OF COAL COMPLETELY DEPOSITED ON RETURN STROKE

Diagram showing the Action of the Discharging and Charging Apparatus of West's New Power-Stoker.

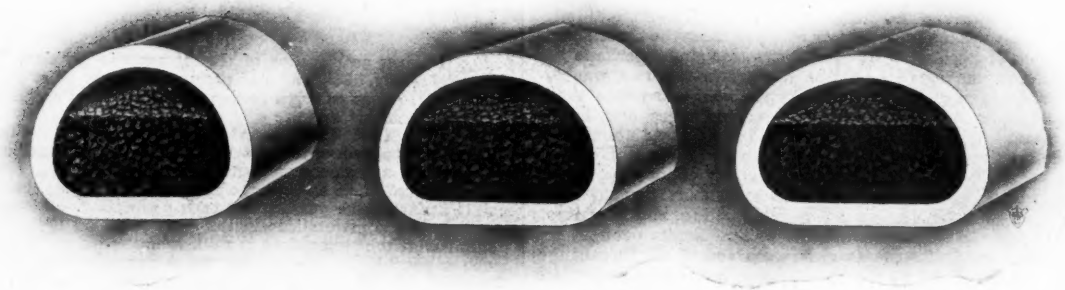
complement of attendants; and although the one machine performs the duty of a plurality of predecessors, it is remarkable that it is of simpler construction than the latter.

The power-stoker may in many respects be described as an adaptation of West's telescopic-ram discharging machine for discharging the coke from through retorts, and a novel telescopic scoop which conveys the coal into the retort when following the ram-head as the latter drives the coke forward; the coal being deposited in the retort on the return stroke of the ram and scoop to the machine. We must pause to remark upon this fact, that the coal is deposited by a scoop, inasmuch as it is a system that Mr. John West has always maintained to be the best to assist in obtaining good carbonizing results—his lengthy experience of coal carbonization asserting the view that the coal should be lightly laid and in a regular layer throughout the length of the retort. It is also to be noted that the charge of coal laid by the machine is so invariably uniform that the removal of the resultant coke is facilitated.

The complete machine consists of a travelling trolley framework for supporting a coal-hopper; and the combined discharger and scoop, with the usual motor and gear for adjusting the machine to the retort, as is common with the other well-known



Section of a Retort showing the Layer of Coal deposited by West's New Power-Stoker.



Dimensions -	22 inches by 16 inches.	24 inches by 16 inches.	26 inches by 16 inches.
Weight of coal per charge -	11 cwt.	12 cwt.	13 cwt.

Retorts - 20 feet through.

types of West's machines. It also receives its supply of coal from overhead coal-bunkers, which may have outlets opposite each vertical line of retorts, or the hopper on the machine may be of sufficient capacity to contain a supply of coal for a number of retorts. Referring to the main coal supply, it is interesting to note that the machine is the same height as the other types of West's machines, and consequently can be installed in those retort-houses which already have the separate machines, without the necessity of raising the coal-bunkers. The machine is fitted with West's bunker-door operating gear, which engages with the outlet doors of the overhead coal-bunkers, and enables them to be operated from the machine.

We illustrate an example of a retort-house designed to receive the new power-stoker, which, in conjunction with hot-coke handling plant, will enable the operations of discharging and charging the retorts, the opening and closing of the retort-lids on both sides of the retort-bench, the filling of the furnaces, and the conveying of the coke from the retort-house to be accomplished or directed by three men; and as the floor space on the discharging side need not be so wide as when required to provide for the reception of a machine, an economy in ground area is effected, and the floor can be of lighter construction.

The diagrams, figs. 1 to 5, illustrate the principal actions of the new machine.

Fig. 1 shows the machine in front of a retort from which the coke is ready to be discharged. The attendant then moves the starting-lever of the motor, or controller in the case of an electrically driven machine; and the discharger with the scoop enters the retort—the scoop at the same time mechanically opening the coal-feed from the hopper on the machine, and closing it when it is fully supplied. The completion of the outward stroke, as fig. 3, has caused the whole of the coke to be ejected from the retort, and the coal to be conveyed into the retort at the same time. During the return stroke (as illustrated in fig. 4), the coal leaves the scoop, and is deposited in the retort in a layer as perfectly even as shown in the longitudinal section in fig. 5, and in cross section as shown in each of the three illustrations of examples of retorts of common dimensions and profiles. The machine is applicable to any common section or profile of retort; and it is capable of charging it with the quantity of coal to meet the conditions of eight-hour charges, or the machine can be constructed to suit any special section of retort if so required.

Although the machine discharges the retort and charges it at one operation, the two services may be accomplished separately by the simple movement of a lightly operated lever and rod, which trips the mechanical coal feed-gear, and prevents the coal being fed to the scoop. By this means, the retorts may be periodically inspected or stood-off for scurfing.

As the name given to the machine implies, it is a power-driven machine, and is operated either by electric, compressed-air, or other convenient system of power transmission.

The new machine has already been inspected by a number of gas engineers, who have (as we do now) very heartily congratulated West's Gas Improvement Company on their fresh advance. Among other interesting pieces of intelligence in connection with the new machine is the one that the Directors of the Cardiff Gaslight and Coke Company have placed an order with the firm for the supply of the machine, with coal and hot-coke handling plants, which will form an extension to the retort-house already fitted with West's stoking machinery.

S. B. CHANDLER'S DOUBLE-ACTION ROTARY WASHER-SCRUBBER.

The patentee of this arrangement, Mr. S. B. Chandler, is one of the staff of the South Metropolitan Gas Company, and the eldest son of Mr. Samuel Chandler (well known in connection with rotary gas-purifying apparatus); and it will be seen by the drawing and the extract from the specification reproduced herewith that his invention relates to washer-scrubbers for extracting ammonia and other impurities from gas, where the gas ascends and descends into and through central openings. Many kinds of surfaces have from time to time been introduced, with which, of course, most of our readers are acquainted. It is, however, claimed that the invention under review "encompasses objects the advantages of which are very clear and improvements equally manifest."

In substitution for bundles such as are already known, thin sheets of metal are used after being pierced, stabbed, or forced through all over, so as to leave a number of ragged holes in each square inch (and this is the essential feature of the invention); the object in so treating the sheets being to leave on the reverse side into which the stubby pointed tool enters, a number of protrusions—sharp, prickly points and curled-up ragged edges (see fig. 4 of the specification drawing here reproduced). These pressed ragged holes surrounding each other (as they do) form tiny cups or carriers—*i.e.*, one pressed hole leaves the split metal pointing upwards, downwards, and sideways, as is also the case regarding the holes that are above, below, and at the sides. This results in the formation of little receptacles for liquid all over the sheets. The flow of the gas through the machine continually disperses this large number of drops from edge to edge, on to and among the surfaces—an effect to be appreciated.

Number of segments so prepared are made up into a bundle as usual, and fitted into the scrubber-washer. On being revolved they must unquestionably split up and divide the gas into numberless parts every minute; and the action is, of course, reproduced at each revolution of the wheels. It therefore follows that the liquor is also carried up from the tanks by the rough projections, and divided into a great number of showers of little drops—resulting in a longer time-contact with the liquor surfaces and gas. In addition to this, the gas having the wetted surfaces only to rub against, as previously, is also subjected to the action of "these millions of constantly descending, rolling, moving drops, which, owing to the zig-zag course they must of necessity take, perform an important and additional part in purification."

It is not always a simple matter to make clear the functions or capabilities of apparatus of this description; and perhaps the better plan in this instance will be to explain that in a washer-scrubber containing (say) 12,000 square feet of surface there would be approximately 51,840,000 cutting edges and liquor dividing and lifting appliances, calculated as follows: Thirty protruding edges in 1 square inch = 4320 per square foot at 3 revolutions per minute. $4320 \times 12{,}000 \times 3 = 155{,}520{,}000$, or, taking the gas to be purified at 81,000 cubic feet per hour, it would mean that every 1350 cubic feet would be subjected to, and in contact with, this very large number of devices and sheets per minute. These figures and statements may seem somewhat surprising; yet they are borne out by simple facts, easily verified, and at all events may afford some idea of the possibilities obtainable.

In a model sent for our inspection, it is shown that, in practice, the spaces between each sheet are $\frac{5}{16}$-inch, and that the projections extend only half-way. Thus a good open area is left between the plates for freely washing as they revolve through the liquor. It is necessary to mention this as the reproduction of the drawing being necessarily small, may not convey the idea intended.

Abstract of Patent Specification, No. 214, Jan. 4, 1910.

The invention relates to washer-scrubbers used for extracting ammonia and other impurities from gas, of the kind in which a number of discs or wheels rotate in bays or tanks, each disc comprising a number of "bundles" or segments composed of a number of boards or thin plain metal sheets held together by side enclosures which are secured to the frame plates. The invention consists in the use of plates not of the ordinary kind, but perforated in such a way that they will be more effective than those hitherto used for the purpose.

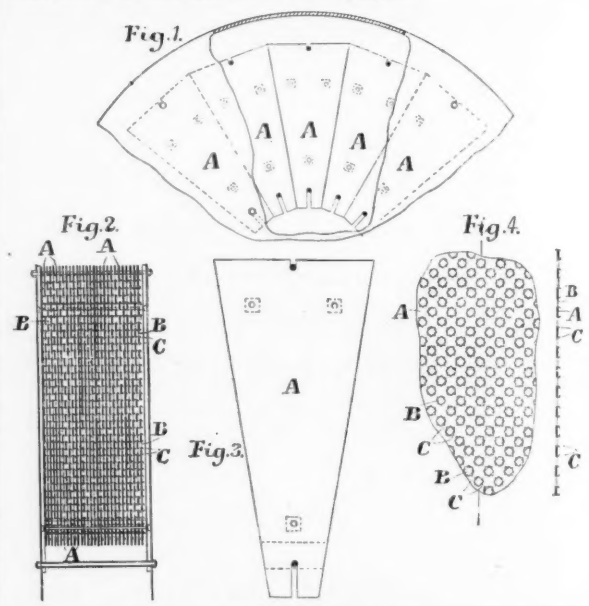


Fig. 1 shows an elevation of the segments in position. Fig. 2 is a vertical section of a bundle of perforated plates. Fig. 3 is an end view. Fig. 4 is an enlarged section and elevation of a plate provided with perforations.

The plates A are of thin material (preferably metal), and the holes B are pierced, stabbed, or forced through all over, close together, in such a manner as to produce and leave on the reverse side of the sheets which the tool enters a very large number of protruding sharp, prickly points and ragged edges C round each perforation. Alternate plates would have the perforations in the same position; the intermediate plates having the perforations in a different position, so as to zig-zag as much as possible the course of the gas which passes through the plates. The plates are bolted together with distance-pieces between them, as shown in fig. 2.

The patentee claims: 1. In a machine known as a washer-scrubber, the use of plates of metal or other suitable material pierced with ragged-edged holes. 2. In a washer-scrubber, arranging the plates which are pierced with ragged-edged holes in bundles or segments and placing the holes so as to form zig-zag courses for the passage of the gas.

GASHOLDER CUPS.

By F. Southwell Cripps, Assoc.M.Inst.C.E.

It is not too much to say that gasholder cups are very little understood. Their action is a mystery to many. They are designed for the most part by mere rule of thumb, and frequently receive scanty attention. As a result, there are many gasholders which *blow gas to waste every time they uncup*. Gasholders with cups as deep as 18 inches or 20 inches very frequently "blow." What, then, is the reason for this? And what is the remedy?

What "Blowing" Means.

In order to determine whether a cup will "blow" or not, we must keep in mind what the blowing consists of. It means that when the cup lowers into the tank, it takes the water it contains down with it in such a way that, unless the lip of the cup-plate reaches the water-level in the tank (outside the cup) before the water in the cup is lowered below the grip-plate, then blowing must take place. This is the sum and substance of the whole matter. Nothing can be done unless this action is thoroughly grasped; and, therefore, to make it clear, we will glance at figs. 1 to 4.

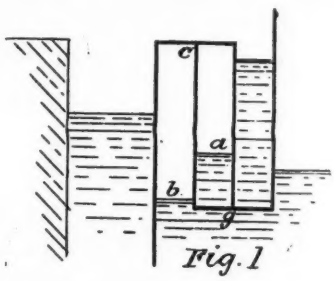


Fig. 1

Fig. 1 shows the position of the cup when the outer lift is just landed; and although the pressure of gas inside the cup may exceed the pressure in the holder, the cup does not blow—the level *a* being well above the bottom edge of grip-plate *g*. The water-level *b* is, of course, well below the lip of the cup *c*.

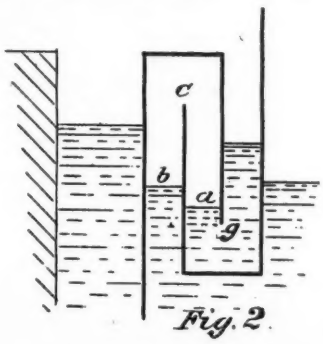


Fig. 2

Fig. 2 shows the cup somewhat lower. The grip is, of course, stationary. The water levels vary; but the exact amount of their variations is beside our present purpose, it is sufficient to note that the water level in the cup has been carried down, bringing the level *a* nearly to the bottom of the grip *g*. At the same time, the level *b* (outside the cup) rises at the same rate as *a* falls. Hence, if *b* can reach the top or lip of the cup-plate *c* before *a* reaches *g*, then water will flow into the cup and prevent its blowing.

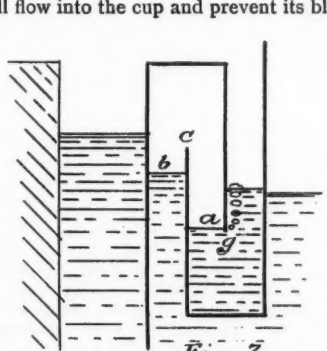


Fig. 3

Fig. 3 shows that *b* has not succeeded in reaching *c* in time to prevent *a* falling below *g*; and therefore gas escapes and blows to waste.

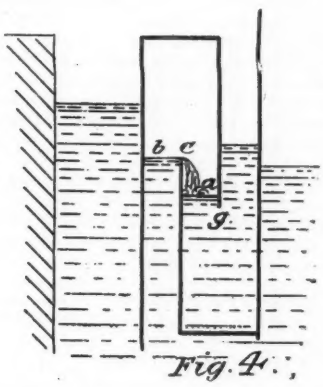


Fig. 4.

Fig. 4 shows what the effect would have been if *b* had succeeded in reaching *c* before *a* reached *g*.

Upon consideration, we shall find that it is only in this way (fig. 3) that it is possible for a cup to "blow" gas to waste when uncupping; and, on the other hand, if the cup does *not* blow, it is only avoided by the action shown in fig. 4.

The Remedies for Blowing.

Now, presuming that we have a cup which would blow in the manner indicated in fig. 3, can nothing be done to obviate or remedy it? Yes; all that is required is to *admit water to the cup just before the critical stage is reached*. This can be done in two ways:

1.—*By raising the overflow level in the tank so that the grips of all the lifts are entirely under water during the process of uncupping.*

2.—*By piercing the cup-plate with what we may term "flooding holes" at a level just below b in fig. 3.*

Both these plans have been tried and with perfect success. A few words about each, before proceeding to a more detailed treatment of the subject.

1.—Mr. G. E. Stevenson advocated this plan in a letter which appeared in the "Journal" for Jan. 30, 1894. Raising the overflow in the tank, of course, necessitates making a slightly deeper tank; but it must be remembered, as a set-off against this, that the effective capacity of the holder is increased thereby. In many multi-lift gasholders, the water level in the tank, when the holder is down, is very much lower than the top curb; so that not only does the domed crown of the holder contain a stock of gas which it can never deliver up, but the cylindrical portion of the holder does likewise, to a depth of perhaps 12 or 18 inches, according to the position of the tank overflow level and the pressure given by the holder. If, for example, the overflow level is 6 inches below the top curb—a very ordinary case—and the pressure given by the gasholder when full is 9 inches, the water-level falls to a level of 9 inches below the overflow, or 15 inches below the top curb when the holder is at rest in the tank. We, therefore, see there is a loss of 15 inches in effective depth of the holder, due to the low position of the overflow. Allowing the grips to be flooded, by raising the overflow, would not therefore be without advantage in other ways than that of preventing the cups from blowing.

We must, however, in adopting this plan, make certain that *all the grips are flooded during uncupping*. It will not do to apply it to the outer lift only; the water overflow level must be raised above the top of the grips by a distance somewhat in excess of the pressure given by all the lifts except the inner lift. For example, a gasholder giving a total pressure of 10 inches, of which the inner lift gives 4½ inches, must have the tank overflow level raised more than 10 in. — 4½ in. = 5½ in. *above* the grips, or, to be safe, say 6½ inches, so as to allow for ordinary irregularities, evaporation, &c. The greatest care must also be taken to *maintain the water level*, by making good any losses caused by evaporation or leakage. Otherwise, should the rainfall be insufficient to make good the deficiency, the water will not cover the innermost grips when uncupping, and if it does not do so, then it will probably blow. Moreover, under such circumstances, it will blow to a greater extent than if the water level in the tank was kept at the lower level in the ordinary way—in fact, some leakage from the tank when the overflow is below the top of the grips does not increase the liability of the cups to blow, but the reverse.

Before leaving this point, we may note that the low water-level in the tank is the reason why many gasholders do not blow when uncupping. Many gasholders which do not blow at the present time, would do so if the tank overflow level were raised, unless it be sufficient to cover the grips during the whole time of uncupping. It is therefore important to exercise the greatest care, and consider the matter scientifically, before making any alterations of the kind suggested.

2.—We now come to the second method of overcoming "blowing," where the cup has not been designed in such a way as to render blowing impossible under ordinary conditions of working. The *piercing of the cup plate by flooding holes* is an exceedingly neat and effective method of accomplishing the end desired, as it admits of the water-level being raised or lowered in the tank to any extent within reason, and allows of much shallower cups being

used than could otherwise be done. The author has introduced this system in cases where it would otherwise be impossible to add new lifts to gasholders owing to the shallowness of the existing cups, and with perfect success. The number and size of the flooding holes required to give satisfactory working may be taken at two in each bay round the holder. They should be about 1½ inches diameter, or elongated holes about 2 in. by 1 in. are preferable.

We cannot, however, determine whether a cup will blow, nor the level at which to place the flooding holes, without following the action of the water in the tank, step by step, during the process of uncupping. If we find that at any stage the water level *a* (fig. 3) falls below the grip-plate at *g*, we then know that it will blow. And, further, if we note the exact position of the lip of the cup *c* when this is about to take place, as well as the water level *b*, we can at once fix the position where flooding holes are required.

Uncupping.

The conditions which arise during the process of uncupping vary, thereby necessitating variations in the treatment. These we will take in succession, by choosing examples to cover all cases likely to arise in actual practice.

Notes.

In the following diagrams—

All water levels in the tank outside the gasholder are lettered .	T
,, ,, in the tank inside the inner lift	W
,, ,, between the cup-plate and the next lift . . .	G
,, ,, ,, ,, and the grip-plate . .	C
,, ,, outside the grip-plate	E

The successive levels in each space—that is, under each letter—are numbered 1, 2, 3, &c., corresponding with the successive stages in the uncupping.

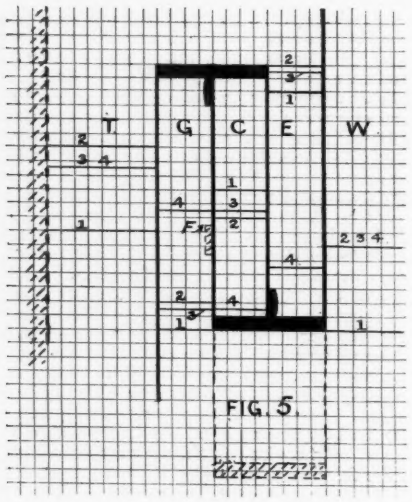
When the distance between two levels is referred to, such as W_1 T_1, it means the difference between the water-level line W_1, and the water-level line T_1.

The thick lines (top and bottom of cup and grip) denote the thickness of the rest-block, added to the thickness of the channel or bent plate.

Case I.

Example 1.—Three-lift gasholder. Cups, 18 inches deep (effective). Depth over cup and grip, 19 inches. Water overflow level, 6 inches from top of grips. Pressure of gas given by three lifts = 4 in., 1½ in., and 1½ in. respectively, or a total of 7 inches. Proceed as follows:—

(1) Sketch, in outline only, the lowermost cup and grip, on sectional paper (four to an inch is a convenient size). Every division on the paper may be taken to represent one inch, as shown in fig. 5. [Note: The diagrams accompanying this paper are to a smaller scale than should be adopted in actual practice.]



(2) Show the water-levels when the cup *just touches the water*.

W_1 represents water-level inside holder.

G_1 ,, ,, ,, in grip space.

T_1 ,, ,, ,, in tank when distance W_1 T_1 = total pressure of gasholder—viz., 7 inches.

E_1 is the level of water in outside of cup. This level is assumed to allow for evaporation, &c.

C_1 is the level inside the cup (distance C_1 E_1 = the total pressure, 7 inches).

This is the first position the water-levels take up with respect to the cup and grip; and therefore all levels are marked 1.

(3) Now to find the second position. This is when the cup has sunk into the water and is just about to land the outer lift. All the letters are marked 2.

T_2 is the distance of overflow level from top of grip.

Make W_1 W_2 = T_1 T_2.

Make E_1 E_2, C_1 C_2, and G_1 G_2 each equal to one-third of W_1 W_2.

(4) The third position is when the weight of the outer lift is landed. This causes the water outside the holder—viz., T_3—to fall to T_3, a distance equal to the reduction of pressure 1½ inches. W_2 remains, for all practical purposes, stationary.

Make E_3 and G_3 each one-third of T_2 T_3 below E_2 and G_2 respectively.

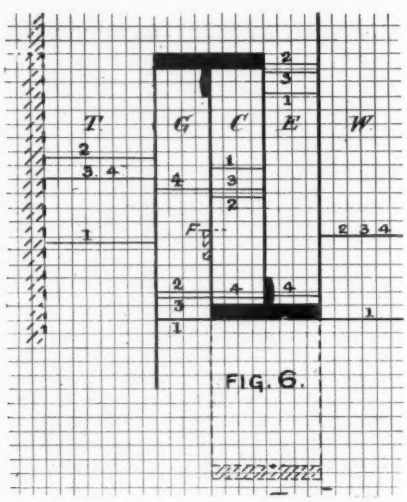
Make C_3 one-third of T_2 T_3 above C_2.

(5) The cup now begins to descend, leaving the grip stationary. Assume, for safety, that to avoid blowing, the water level C_3 should not approach nearer than ½ inch to the bottom of grip-plate. Draw C_4 at that level. Now, the distance the cup will fall before C_3 reaches C_4 is 1½ times C_3 C_4. Mark a point on the cup-plate 1½ times C_3 C_4 below the lip, as at F. The water level G_3 will, when the lip of the cup has fallen to F, have risen a distance of G_3 G_4 = C_3 C_4.

E_3 falls to E_4 a distance = twice C_3 C_4.

It will be seen in the present example, therefore, that the water-level G_4 overflows the cup at F before the water-level C_4 descends too low for safety—that is, it will not "blow."*

Example 2.—Before proceeding further, we will ascertain if the inner lift cup would blow. It is always desirable to do this, because the water level E not only falls by evaporation, but is lowered by a distance equal to half the pressure of the outer lift.



The numbered letters in fig. 6 show the successive stages; and, therefore, it is unnecessary to repeat the explanation. All that we need note is that, in the first place, E_1 and T_1 are lower than in fig. 5, and that in the final stage the water-level G_4 rises above the lip of the cup F in good time to prevent any blowing taking place under the grip-plate.

Example 3.—We will now alter the conditions somewhat, still taking the same proportions of cup. Let the overflow level be only 3 inches below the tops of the grips and the pressures 5½ inches, 2¼ inches, and 2¼ inches respectively.

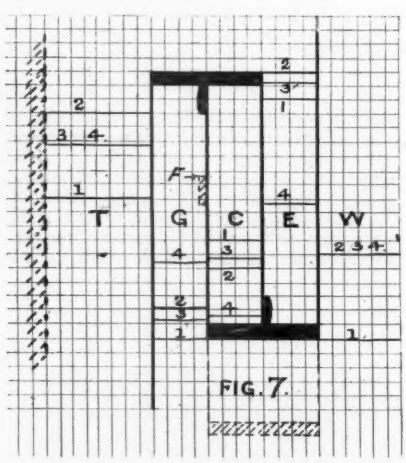
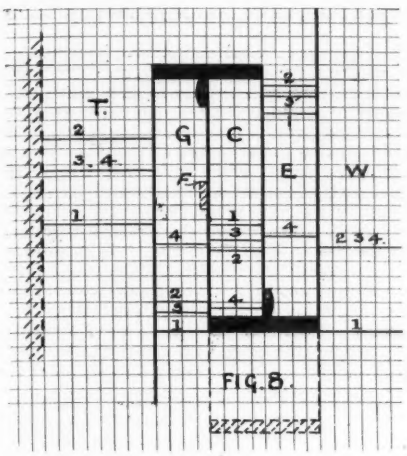


Fig. 7 shows the action in a similar manner to the preceding examples; but we note that the water-level G_4 has not reached the lip of cup F before the water-level C_3 has arrived at C_4. We therefore know that it would blow. To obviate this defect, flooding holes should be put through the cup-plate (say) 1 inch below the level G_4—that is, at a distance of about 7 inches below the lip of the cup. The cup would not then blow.

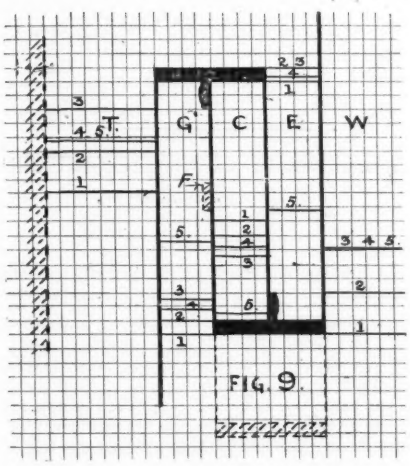
*Note.—In this and other examples where blowing does not occur, the level G_4 is shown above the lip F; but, in reality, the water would, of course, flow over F into the cup, and thus prevent the grip becoming unsealed. All that we need note, however, is that if G_4 is above F the cup will not blow.



Similar treatment of the inner lift cup would show that this would likewise blow, and that flooding holes would be required at a level of 5 inches below the lip (see fig. 8).

Case II.

The foregoing examples belong to what may be termed the simplest case. The next example will present more difficulty, because water will flow out of the cup and over the top of the grip into the tank as the cup enters the water.



Example 4.—Taking the same cup (fig. 9) as before, let us assume that the water-level at E_1 is only 1 inch below the top of the grip; otherwise let the data be the same as in Example 3.

(1) Commence by showing W_1 G_1 T_1 E_1 and C_1 in their proper positions, when the cup has just touched the water in the tank (see fig. 9).

(2) Let E be just on the point of overflowing the grip at E_2.
Make W_1 W_2 = three times E_1 E_2.
„ T_1 T_2 = three times E_1 E_2.
„ C_1 C_2 = E_1 E_2.
„ G_1 G_2 = E_1 E_2.

(3) Next show T_3 at the level of overflow below top of the grip.
Make W_2 W_3 = T_2 T_3.
„ C_2 C_3 = half of T_2 T_3.
„ G_2 G_3 = half of T_2 T_3.
E_3, of course, remains at E_2 level, as the water is overflowing the grip.

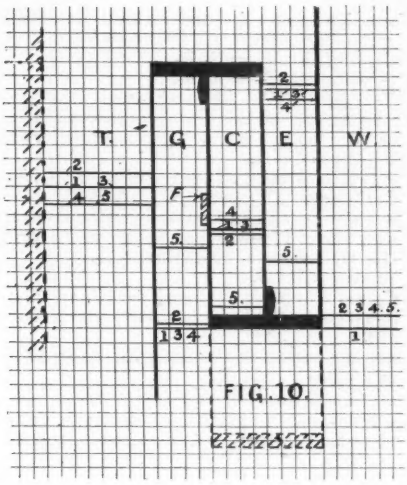
(4) After landing the outer lift, the levels become
T_3 T_4 = pressure of outer lift = $2\frac{1}{4}$ inches.
C_3 C_4, G_3 G_4, and E_3 E_4 are each equal to one-third T_3 T_4.
W_4 remains at the level of W_3.

(5) Now to test the cup for blowing. Let C_5 be (say) $\frac{1}{2}$ inch above the bottom of the cup, as Example 1. Then the lip of the cup would descend to F, a distance of one-and-a-half times C_4 C_5, and the water-level G_4 would rise to G_5, when the water in the cup is within $\frac{1}{2}$ inch of blowing—viz., at C_5. Hence, as G_5 is below F, the cup would blow, and flooding holes should be put through the cup-plate slightly below G_5 (say) 5 inches down from the lip.

Case III.

The next example treats of a case where the gas pressure in the cup forces the water in G down below the bottom of the cup, thereby letting gas escape back into the holder.

Example 5.—Let the proportions of the cup and the pressures be as in the last example, but make the tank overflow level 8 inches below the top of the grip instead of 3 inches, and let E_1 be 2 inches below the top of the grips. Then proceed as follows:—



(1) Show W_1 G_1 T_1 E_1 and C_1 in their proper positions when the cup has just touched the water in the tank (see fig. 10).

(2) Make T_2 level with the overflow = 8 inches below the grip.
Make W_1 W_2 = T_1 T_2.
„ G_1 G_2 = one-third of T_1 T_2.
„ C_1 C_2 = „ T_1 T_2.
„ E_1 E_2 = „ T_1 T_2.

(3) Now show G_3 so that gas is just on the point of blowing under the cup into the holder.
Make C_2 C_3 = G_2 G_3.
„ E_2 E_3 = G_2 G_3.
„ T_2 T_3 = three times G_2 G_3.
W_3 remains at W_2 level.

(4) Make T_3 T_4 = pressure given by the outer lift, $2\frac{1}{4}$ inches. Then as G_3 remains stationary, G_4 will be level with the bottom of the cup.
Make C_3 C_4 = half of T_3 T_4.
„ E_3 E_4 = half of T_3 T_4.
W_4 remains at W_3 level.

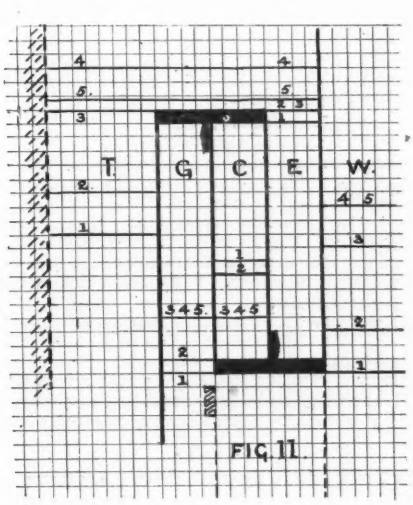
(5) To test for blowing, allowing the margin of $\frac{1}{2}$ inch as before, we have,
F equal to one-and-a-half times C_4 C_5 from the top,
and G_4 G_5 = to C_4 C_5.

We see therefore that as C_5 has not reached F, gas would blow to waste when uncupping, and, therefore, flooding holes should be put through the cup-plate at a level of about 4 inches from the lip of the cup.

Case IV.

The only other case which is likely to arise with the ordinary cup, in practice, is that of flooding the cup from the outside, due to the grip passing right under the water before it uncups.

Example 6.—Repeat the diagram as before, but make the tank overflow 3 inches above the top of the grip. Let E_1 be 1 inch below the top of the grip before the grip is immersed, and let the pressure given by the three lifts be $5\frac{1}{2}$ inches, $2\frac{1}{4}$ inches, and $2\frac{1}{4}$ inches respectively, as in former examples.



(1) Show W_1 G_1 T_1 E_1 and C_1 as before, for cup just touching the top of the water, as in fig. 11.

(2) When E_1 rises to E_2—that is, level with the top of the grips—the other levels will be as follows.
C_1 will fall to $C_2 = E_1 E_2$.
G_1 will rise to $G_2 = E_1 E_2$.
$T^1 T_2$ and $W_1 W_2$ will each equal $3 E_1 E_2$.

(3) When the top of the grip has descended to the level of the top of water T_3, the other levels will be
$W_2 W_3 = T_2 T_3$.
E_3 will be level with the top of the grip, like E_2.
$C_2 C_3 = \frac{1}{2} T_2 T_3$, and $G_2 G_3 = \frac{1}{2} T_2 T_3$.

(4) When the grip is just on the point of uncupping, the water-level T_4 will be 3 inches above the top of the grip.
E_4 will, of course, be level with T_4.
$W_3 W_4 = T_3 T_4$.
C_4 and G_4 will remain level with C_3 and G_3; and from this position they will not alter during the remainder of the uncupping.

(5) When the weight of the outer lift is landed, T_4 and E_4 will fall to T_5 and E_5.
W_5 C_5 and G_5 all remain stationary.

The cup will descend in the tank, leaving the water in the grip standing at this common level, and therefore it cannot blow.

Case V.

The grip-plate is occasionally taken up higher than the top of the grip, so that a greater quantity of water may be held in the cup under pressure, and the necessity for a deep cup is avoided (see fig. 12).

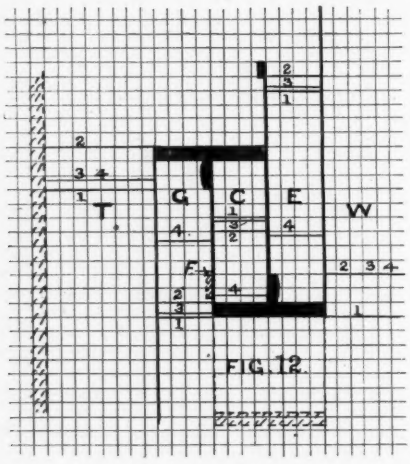


FIG. 12.

This case may be treated precisely as Cases I. and III. in the early part of this article. The vertical plate prevents the water overflowing the top of the grip, and therefore brings it under Cases I. and III. But as this case allows of making the cup very shallow, it will be interesting to give one example of it.

Example 7.—Let the cup be 12 inches deep, and the grip-plate project 6 inches above the top, as shown in fig. 12. Tank overflow level with top of grip. Pressures of three lifts, 4½ inches, 2¼ inches, and 2¼ inches respectively.

Then proceed as in Case I. It is unnecessary to explain the process again, as the successive stages are indicated by the numbers on fig. 12. It will be seen that, although the cup is only 12 inches deep, the water-level G_4 rises above the lip of the cup F long before the water in C would fall to C_4. Hence the cup cannot blow.

Axioms.

The following axioms apply to all cases, and should be borne in mind when working examples:—

1. G T must always equal E C.
2. $W_1 W_2$ must always equal $T_1 T_2$.
3. Water in the tank (inside inner lift) is always at one level after the holder has once been fully inflated—viz., at a depth below the overflow equal to the pressure given by the gasholder when full. (The different levels shown in diagrams for W denote that the cup has sunk that much in the water; but the water itself remains stationary. It is shown thus to avoid multiplying diagrams.)
4. Gas space inside the cup and grip does not alter in volume—that is, the distance of G and C from the top of grip added together never varies.
   Note.—Strictly speaking, 3 and 4 vary slightly; but the variations are so small that they have no appreciable effect; therefore they are treated as *nil*.

Notes.

It will be noted that only what are usually termed "channel cups and grips" have been dealt with; whereas many gasholders are made with bent-plate cups and grips, very generally called "Piggott's cups." In such cases they may, for all practical purposes, be treated as if they were of the ordinary channel type, of equal depth. To allow for the curved form would introduce tedious complications, which are not justified by the difference in results.

The width of the spaces G C and E have been treated as equal throughout, whereas they sometimes vary. But this so rarely happens that it is scarcely necessary to give examples.

In conclusion, it should be stated that the author, in order to make the directions given of practical use and easily handled, has refrained from proving the accuracy of the directions laid down. To have introduced proofs at every successive stage would have increased the length of the article considerably, besides rendering it obscure, thereby defeating the object in view. For proof of the principles involved, reference may be made to a series of articles published in the "Gas World" in 1899. The author was associated with the writer of those articles (not a gas engineer) in their production, and ventures to assert that a more comprehensive and scientific demonstration of the theory of the action of gasholder cups has never been written. Earlier efforts may be mentioned, but they only touched the fringe of the subject, and only treated of isolated cases. Of these, the following may be noted:—

M. Arson	"Notes on French Practice in the Construction of Gasholder Tanks and Gasholders." (Translated by Dr. Pole, F.R.S.)	"Journal of Gas Lighting," Vol. XXIX., pp. 12, 49, 84, 121. Also King's Treatise, pp. 191-193.
MM. Monnier and Thibaudet.	"A Study on Gasholder Construction."	"Journal of Gas Lighting," 1881, April 19, p. 656.
Various authors .	Discussion on Gasholder Cups. Channel Cups *versus* Bent Plate Cups.	Correspondence in "Journal of Gas Lighting," from March 5, 1889, to April 30, 1889.
W. E. M'Kay . .	"The Gasholder Cup in Practice and in Theory."	"Journal of Gas Lighting," Jan. 23, 1894, p. 150. Also "American Gas Journal" for Jan. 11, 1894.

A GASHOLDER CONFLAGRATION:

A REMINISCENCE.

By William Key,

Formerly Manager of the Tradeston Gas-Works, Glasgow.

During the late seventies, we in Scotland were still diligently doing our best to maintain that impossible standard of 25 to 26 candle gas which was then considered necessary—employing every artifice, in "faking" the appliances and bringing up new batteries under every conceivable cover in order to meet, and be prepared to nullify as much as possible, the approaching onslaught of irresistible King "John"—otherwise "Jack Frost." Regrets, when one was tempted to reckon up the number of hundreds of pounds value per week which had mysteriously disappeared by the subtle methods so ruthlessly enforced by his attacking powers, were utterly worthless; and one felt inclined to say that the gold might as well have been sent to the bottom of the Clyde. This thought—engendered by irritability at the futility of our defences—was, however, an error, knowing as we did that, to a considerable extent, the cash was recoverable during the months of summer; for by the end of September, on opening a manhole on a gasholder crown and examining the surface of the water within, every vestige of spirit had disappeared, and during the period of its evolution—say for six months—large sums for coals had been saved by carbonizing with a much inferior quality than would otherwise have been required.

It was during that winter of six months' continuous frost, but very little snow, that the deposit of spirit from the high-priced coals which had to be used became so heavy that from within the holders it more than counterbalanced the weight of water on the outside; and occasionally, if the holder rose to its full height, quantities of spirit bubbled to the surface and were immediately taken up by, and frozen into, the ice from which it was scarcely possible to keep the lutes clear. This holder being the heaviest, its inlet was generally open; other holders being filled by drawing from it. Many men were engaged, both day and night, keeping the water-channels from becoming solid.

On one particular afternoon, the author found that the odour from spirit in the ice surrounding the holder was particularly strong, though there was not any appearance of spirit on the surface of the water; and, as a precaution, he personally awaited the arrival of the men who were to take over the duty of keeping the lutes clear during the night shift. The men were warned very particularly of the danger of having any artificial light; and each was personally instructed how to act. As the light from 3 inches of snow on the ground was quite enough for their purposes, they were told they required no other; and in this they agreed.

The author resided within 200 yards of the works, and had been asleep an hour when he was aroused by the furious ringing of the bell. On opening the door, a man, prostrated and fairly gasping for breath, was there, but unable to utter a word. His face, however, spoke volumes, and told enough. In a very few minutes the

author was out under a most brilliantly illuminated sky, and, turning a corner, came in full view of the holder, more than half full of gas (when full it would contain 1¼ million cubic feet), and completely enveloped in flames. Running towards it, and intercepting the men, who were tumbling heels over head over the walls into the roadway, he took them all back by the gate, and sent for more men from the night foreman and for dozens of empty sacks. Having wetted the sacks and collected the men at one point, the author started them to divide the flaming spirit, drive it right and left, and chase it along in opposite directions. In this they were successful; and the flame slowly diminished in height. Having succeeded in keeping one side clear, the originator of this furnace was dispatched to draw as much gas as possible from the holder into others, while the author, by means of the governor, put another inch of pressure on the street mains, and thus brought down the holder to a height of 30 feet or thereby.

Another danger, and what to the author seemed a most serious one, now commanded attention. Many great jets of gas were playing with a roaring force and noise upon the bases and the holder sides of all the cast-iron columns, which were becoming red hot. Sending for a barrowful of clay and some retort-patching tools, he had begun to master these jets when the Captain of the Fire Brigade arrived with several engines in the roadway adjoining, and, without a moment's delay, was busy unlimbering. The author, however, told the Captain that not a single jet of water would be allowed to play on the flames; and he was advised to return at once and be out of danger. He was also told that should he persist he would be held responsible for whatever happened afterwards. It was explained to him that the columns were red hot and made of cast iron, surmounted by heavy lattice wrought-iron girders, and should a jet of water be thrown on these, the whole framing would come down, and go through the crown of the holder, and probably put his own and his men's "lights" out. The engines were withdrawn; and the remainder of the flame was gradually extinguished.

On examination, it was found that some of the ¾-inch rivet-holes in the sheeting behind the columns, for riveting it to the internal vertical bars, had not come properly opposite the corresponding holes in the bars, and, being against a blank surface, lead rivets had been moulded with snap-heads the same as those of iron, and made to rivet themselves against the bars on the inner side of the sheeting. These melting out allowed the jets of gas (under several inches of pressure) to play on the columns, and nearly caused the collapse of the whole guide-framing structure.

This conflagration was caused thus: The night attendant on the station meters, governors, &c., had not been informed of the author's instructions as to not using lights, seeing that he had nothing whatever to do with the men on the ice work. Noticing that they were working without a light, he obtained and lit a piece of thick tarred gaskin; and, bringing it forward, said: "Here, men, this will let you see better." Almost immediately a small flaming loose portion fell from the torch on to the ice, and a blue flame instantly flashed round the holder, gathering more power by increasing heat. It became yellow; and then, melting the ice in the tank and on the ground, the flames mounted up as high as the holder—40 feet or more in the air. The buckled sheeting had subsequently to be removed and replaced by new plates. The hair on the head of the comparatively young man (probably about thirty-five) who brought the torch, was of a dark hue on his going on duty that evening; on leaving next morning it was quite white.

A day or two later, the author designed his method of preventing gasholder tank water from freezing, by connecting 4-inch flow and return pipes to a low-level boiler, circulating warm water right round the tank, at a cost in mid-winter of 2s. 6d. per week for coke and attendance. The lutes were afterwards fitted with steam circulators.

These shapely gasholder excrescences on the globe's surface are, when full of gas, in themselves absolutely safe from explosion.

Separation of Tar from Gases.—In a recent number of the "Journal of the Society of Chemical Industry," abstracts were given of two specifications of French patents for methods of separating tar from gases. The first was taken out by the Société C. Menzel. The scrubber employed comprises a vertical cylindrical casing divided into superposed compartments by a series of conical partitions; the angle of the cone being about 120°. The partitions are perforated with rectangular openings, about 8 mm. by 2 mm.; the metal being cut along three sides of the rectangle and then bent back so as to form a blade or wing. Immediately above each of the partitions is a similar perforated plate mounted on a central spindle and rapidly rotated. The rotation may be effected by the pressure of the gases against the blades on the perforated plates. The lowest of the rotating plates may have a cylindrical extension with turbine-blades adjacent to a jet in the casing. Means are provided for adjusting the rotating spindle vertically, so as to regulate the distance between the fixed and rotating plates. The several compartments have drain-pipes for the separated liquor. The second patent was taken out by Dr. C. Otto and Co., whose process consists in washing the gas with tar or gas liquor, the temperature of which is not allowed to exceed 80° C. The gas may be cooled before washing, so that the stated temperature cannot be exceeded, or the desired limitation of temperature may be effected by using a sufficient quantity of tar or liquor; or liquor may be added as required.

GAS-WORKS EXTENSIONS AT KILMARNOCK.

The formal inauguration ceremony in connection with extensive additions to the Kilmarnock Gas-Works took place on Saturday, the 26th ult. An invited company of about 140, which included a considerable number of gas managers, assembled at the new Riverside Gas-Works, where they were received by Provost R. Gemmill and Bailie Robert Muir, the Convener of the Gas Committee. Thereafter Mr. C. Fairweather, son of and Joint Manager with Mr. W. Fairweather, conducted the party round the works.

The works at Riverside were opened in 1904. They have, from time to time, been considerably enlarged since then. Perhaps the most prominent addition has been the introduction of an elevated railway, which it was necessary to carry across the River Irvine by a bridge, and for which, also, a large amount of banking was required. The railway, however, is not confined to the service of the gas-works, as, after it has passed through the retort-house, it is carried forward into the Corporation electricity works, which adjoin. Since 1904, the Corporation have closed the old works in Langland Street as a manufacturing centre, and have removed to Riverside considerable portions of the plant, consisting of condensers, purifiers, exhausters, storage tanks, pumps, and machinery. In the works at Riverside, as originally constructed, the retort-bench contained four arches, with settings of sevens, back to back. These have been converted by Messrs. R. Dempster and Sons, Limited, of Elland, into throughs, with a single furnace on the discharging side. There have been added to the bench four new beds of nines, 22 in. by 16 in. by 19 ft. 6 in., throughs, with a single furnace per through arch. The settings are Brooke's patent, of the deep regenerator type, the distinguishing points of which are the particular subdivision of the regenerators, combined with an extra large heating surface for the preheating of the secondary air, the outcome of which is that the setting works with an exceptionally small draught. Each through retort has been fitted with a single 8-inch ascension pipe, placed on the furnace side, so that the men and the stoking machine do not interfere with one another when auguring pipes. The hydraulic mains are of the open lute type. The seal is regulated by a tar-tower, so as to secure a liquor seal; and the foul main is fitted with an 8-inch retort-house governor, so that the seal and vacuum in the hydraulics are kept at a steady minimum. The hot coke on being discharged is delivered, through shoots arranged in the discharging floor, direct into Belton's patent hot-coke trucks, supplied by Messrs. Dempster. The trucks are all fitted with anti-friction bearings, so that one man can handle the coke from a heavy charge without undue exertion. The plant has been working for about six months, with an all-round advantage, in an increased yield of gas, tar, ammonia, and coke, from the same coal as hitherto used, and with a reduced cost of production.

The charging and discharging machinery is electrically driven; but instead of an array of electric motors, only one is installed, and the power is led away by friction clutches to the several motions of the machine. Thus the electric equipment is cut down to the very minimum, which is a feature of paramount importance in small gas-works. The friction clutches are interchangeable, as are the gear wheels, pedestals, &c.; so that one spare wheel will fit into a dozen places. The charging-machine is Toogood's patent, and is of the slow running type; 80 revolutions per minute only being required—the wear and tear being thereby reduced to a minimum. The positive nature of the machine enables it to pack the coal during charging, thereby facilitating the work of the discharger, and incidentally improving the coke from the Scotch coal used. It is a prevalent opinion that it is impracticable to discharge the coke resulting from Scotch coal from horizontal retorts by means of a pusher discharging machine; but it has been found that if the coal be well packed by the machine charger, and the pusher discharger has a steady acceleration of speed, it is possible to deal with 90 per cent. of Scotch coal, and the remaining 10 per cent. also, if it is judiciously mixed. The pusher discharging machine is on the Dempster and Ordish patent, and consists of two telescopic sections only.

The special feature of the machine is that it retains all the advantages of the cooling effect of hydraulics, but omits the difficulty of keeping a tight joint against water pressure in the hot retort. In action, the ram is always full of water, free from pressure, and open to the atmosphere; and a perfectly steady and uniform motion is imparted to both sections of the ram simultaneously, by a unique arrangement of wire ropes, so that both sections work as one and no shock is given to the charge of coke. In fact, the ram appears to float in and out of the retort, so elastic is its motion. Should a charge buckle, however, no damage can result to the ram or to the retort, as the friction clutch slips, and thus acts as a safety escape for the surplus energy. The stoking machine takes its supply of coal from overhead hoppers, by means of a semi-automatic device, which is simple, inexpensive, and reliable, and is such that the stoker can take coal from his position on the machine platform. The overhead hoppers have a capacity of 100 tons storage of coal, and are fed by a distributing push-plate conveyor arranged above the main tie of the roof principals, driven from the head of the existing elevator, which, in turn, is driven by a steam-engine in the breaker pit.

Besides the work which has been accomplished in the retort-house, the Corporation have built a handsome suite of offices at the entrance gate, and inside the yard extensive ranges of work-

shops for blacksmiths, tinsmiths, fitters, &c. There is also a sulphate-house, into which an installation of Wilton's patent plant has been fitted. The total cost of the works to date has been £60,000; the later additions having cost about £13,000. All the work has been done to plans prepared by the Messrs. Fairweather. Contracts have been entered into for the provision of elevating plant for the delivery of coke from the yard into railway waggons.

After the inspection, tea was served in an upper room which is intended for use in connection with the gas-stove department; and a toast list was gone through.

Provost GEMMILL proposed "The Gas Undertaking." He said it was now nearly forty years since the Corporation took over the gas undertaking, paying £45,000 for it. The annual make of gas was then about 30 million cubic feet; now they had an annual output of 173 millions. He thought the success of the undertaking had been due to the way in which it had been managed by the Corporation. They were all aware that Messrs. Fairweather were men who took quite an enthusiastic interest in their work, and that they had left no stone unturned to make the undertaking a success. Another element had leant towards success—that was the harmonious manner in which the whole work went on. The workmen, to a man, were loyal to the gas undertaking, and did their work in a thoroughly conscientious manner. Perhaps he ought to mention that they had always had very able conveners, and very able gas committees. He had never been aware of any occasion upon which their Gas Managers had made any request for funds with which to proceed with improvements, but that the Gas Committee, after careful consideration, had seen fit to grant the request. They must all recognize that the relationship of gas to public health was very clear indeed. Public authorities were concentrating their attention towards the improvement of the public health. It was felt that they must have a purer atmosphere. They would have observed that in Glasgow a crusade had been started in favour of purer air. They could only have this by inducing householders to use gas for domestic purposes. They knew that the cheaper the gas the more of it was consumed; and the object of the extensions they had seen that day was to enable them to provide gas at a cheaper rate than they had hitherto been able to do. He was convinced that they would be able to supply gas at an early date at 2s. per 1000 cubic feet.

Bailie R. MUIR, the Convener of the Gas Committee, in acknowledging the toast, said that a gas company was formed in Kilmarnock in 1822, by a few prominent and enterprising gentlemen. They had by no means an encouraging reception, because all over the country there was very great fear with regard to being near gas-works. In fact, so much was this the case that in some of the early concerns they were not allowed to lay their pipes near to public buildings. At that time there was a very worthy Bailie in Kilmarnock, who was a far-seeing man. In fact, previous to the Gas Company being started, he had erected a small gas concern of his own, and used it in connection with his workshops. This gentleman invited the new Company to come to Morton Place, near to where his workshops were, where there was plenty of open space. The result was that they placed the old gas-works in the highest part of the town. When Bailie Morton's attention was called to this in later years, he confessed that they had made a mistake, because at that time it was thought that the higher the gas-works were placed, the better it would be, because the gas would run down. The Company started with a capital of £4000. It was a comparatively small beginning. The population of Kilmarnock then would not be more than half what it was now. At that time consumers had the option of taking gas either by meter or at so much per burner. The price by meter was 13s. 6d. per 1000 cubic feet; by burner, 10s. per annum. The burner was a cockspur burner, and it had to be put out at 10 o'clock at night. But the people used to close their shutters, and go on using gas after that hour; and there was so much friction, that latterly the supply of gas per burner was abolished and meters were alone used. When, in 1871, the Corporation took over the gas undertaking, the price of £45,000 which they paid worked out at £1500 per million cubic feet. This was a very stiff price. In 1871, the price of gas was 5s. per 1000 cubic feet. As time went on, the Corporation, he might say, rebuilt the old works. Not only were the works rebuilt, but he could not say how many miles of pipes were laid through the streets. All the expenditure for this had come out of revenue; and the result was that the whole of the borrowed money in connection with the old works was now reduced to about £13,000. For the new works, they had bought 16 acres of land, paying about £400 per acre for it. The cost of erecting the works had been some £60,000; so that the whole debt on the works now was about £75,000. According to the make of gas, their works now stood at the figure of something like £420 per million. All the extensions to works, in both the old and the new works, had been planned and engineered by Messrs. Fairweather. They had never had to employ either an architect or a gas engineer to do a single thing in connection with the extensions. There were two reasons for removing the works to the new site. In the first place, they were hemmed in on every side, and had no room for extensions; and, in the second place, the works were very badly situated, being so high. The new works were in the lowest part of the town; and they had a good supply of water, which was a great saving in the manufacture of gas.

Dean of Guild SMITH having proposed "The Contractors,"

Mr. E. J. KING, of Messrs. Robert Dempster and Sons, Limited, in replying, said that their contract was entered into last March, both for the new bench and the re-modelling of the existing bench. It had been completed for some time, and Mr. Fairweather had told him that since the installation had been at work the make of gas had increased by 400 or 500 cubic feet per ton of coal carbonized, which was certainly very satisfactory indeed, as it was testimony to the economy of the producer, and also that 1400 or 1500 tons more coke had been sold this year; thus showing how economical the new furnace was over the previous one. He thought that the results obtained fully justified the expenditure that had been incurred; and he sincerely hoped, as one of the Contractors, that the installation would continue to do excellent work, to the advantage of the Corporation of Kilmarnock.

Mr. G. MORISON proposed "The Managers." They knew, he said, that in Mr. Fairweather they had one of the ablest Managers in Scotland; and in his son they had a replica of their Senior Manager, who was keeping up the reputation of the name in a way that they must all appreciate.

Mr. C. FAIRWEATHER, in the course of his reply, said that the first sod of the new gas-works was cut on April 10, 1902; and the works were inaugurated on May 10, 1904. The Town Council then began to take into consideration for what length of time they would retain the old works in operation. They thought it would be better to remove them slowly, both for reasons of convenience and also for reasons of finance. The railway, as a first step in the process, was brought into use on Oct. 17, 1906, and then three years were fixed as the period within which the complete translation of the works was to take place. This had been accomplished; and now they had a complete works at Riverside. There had been a great deal of work in connection with the complete translation; but the whole of the contractors who were chosen by the Gas Committee had carried through their work thoroughly and well. As to the working of the plant, the class of coal they obtained was a very difficult one to deal with. In fact, with some of the coal in the district it was more like trying to discharge a retort filled with slates than with coal; and the result was that the machinery was very severely strained. But he thought it said a great deal for the machinery supplied by Messrs. Dempster that it did this work. He believed that, with a careful selection of coal, it would be found to work very satisfactorily in the coming season. As Managers, they did not think that the gas undertaking in Kilmarnock was quite dead. They had had a good many of their consumers taken away by the electric light, which was only natural; but they had more work to do now than they ever had. At the present time the output of gas was 10 million cubic feet more than it was in the corresponding period of last year.

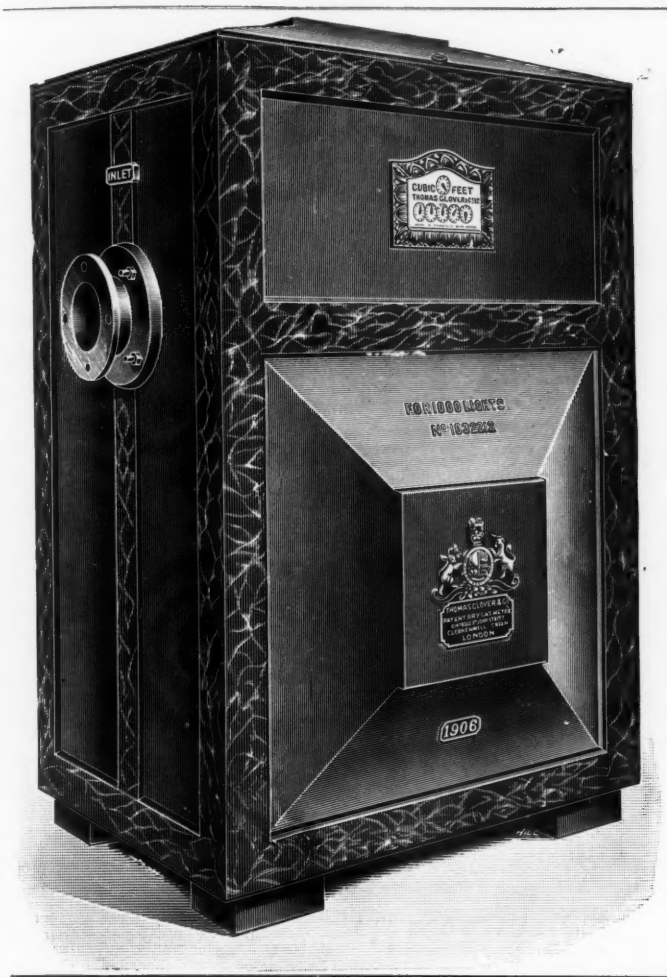
Rev. W. DUNNETT, in proposing "The Chairman," said they ought to be very pleased that the discovery of gas for lighting purposes was made by an Ayrshire man. It was only a matter of about 120 years since the first use of gas for lighting purposes was made by William Murdoch, in lighting his own house; and they had that day seen the latest height of improvement and development at present attainable. They were indebted for these developments and improvements to the liberal-mindedness and spirit of enlightenment of those who were charged with the public interests of large communities such as theirs.

SIMPLE SETTING OF VERTICAL RETORTS.

IN addition to the installation of vertical retorts on the Dessau system now approaching completion at the Sassafras Point Station of the Providence (R.I.) Gas Company, referred to in the last number of the "JOURNAL," one on a system designed by the Gas Bench Construction Company, of St. Louis, which is stated to be specially suitable for small or medium-sized works, being simple and easy of operation, has been put up at Columbia, Missouri. According to some particulars in "Progressive Age," it consists of two benches of fours, with one generator or producer, so arranged that the gases can be directed to all eight retorts or to only four, as may be required. The recuperators are built in two banks, one on either side of the producer, each bank having divided secondary air. The retorts are 10 ft. 6 in. long, will hold a charge of 1000 lbs. of coal, and can be operated with eight, ten, or twelve hour charges. At present, the longest period is preferred. It is stated that the heats are very uniform throughout the length of the retort, and are easily controlled. The fuel consumption runs about 15 lbs. per 100 lbs. of coal carbonized; but it would be reduced if all of the retorts, instead of only four, were worked.

The scheme of handling the coal and coke in connection with these benches of retorts was worked out by Mr. Sylvester Watts, the owner of the Columbia works, and is as follows: The coal is drawn from the store in a "sulky"—a skeleton frame made to receive the coal-bucket. The bucket is raised by a small electric hoist to a trolley arranged over the retorts and furnaces; and, by means of a flap, the coal is discharged into the retort. The sulky is then put under the discharging end of the retorts with another bucket, into which the coke is drawn. The coke drops from the retorts instantly when the lower mouthpiece lids are opened. These are operated by a system of levers by the man standing in front of the bench; and he is not required to go under it. The lids are self-sealing, and are provided with wearing shields, to protect them from the wear of the discharging coke. The sulky, with the coke-bucket, is then withdrawn from under the bench, and is quenched under a shoot. The bucket is then lifted from the sulky by the electric hoist, and is carried on a trolley over the furnace, and the coke discharged thereinto; or, if not required for fuel, the bucket is carried on the trolley over the yard and emptied on the coke heap. The furnace is filled every twelve hours, and requires clinkering only once a week; but it is stated that, owing to the low temperature at which the furnace operates, there are practically no clinkers in the furnace.

The constructors of this bench of vertical retorts claim that it produces from 6 to 8 per cent. more gas per pound of coal than do the horizontal benches in the same works. The quality of the coke is very much better than that from the horizontals, being very dense and hard, and resembling in texture that produced by bee-hive coke-ovens. There is practically no breeze or waste. Among other features claimed for these retorts are that there is no naphthalene produced, that there are no stopped ascension-pipes, and that the quality of the tar is very much better than that produced by the horizontal retorts—being more in the nature of an oil free from lampblack.



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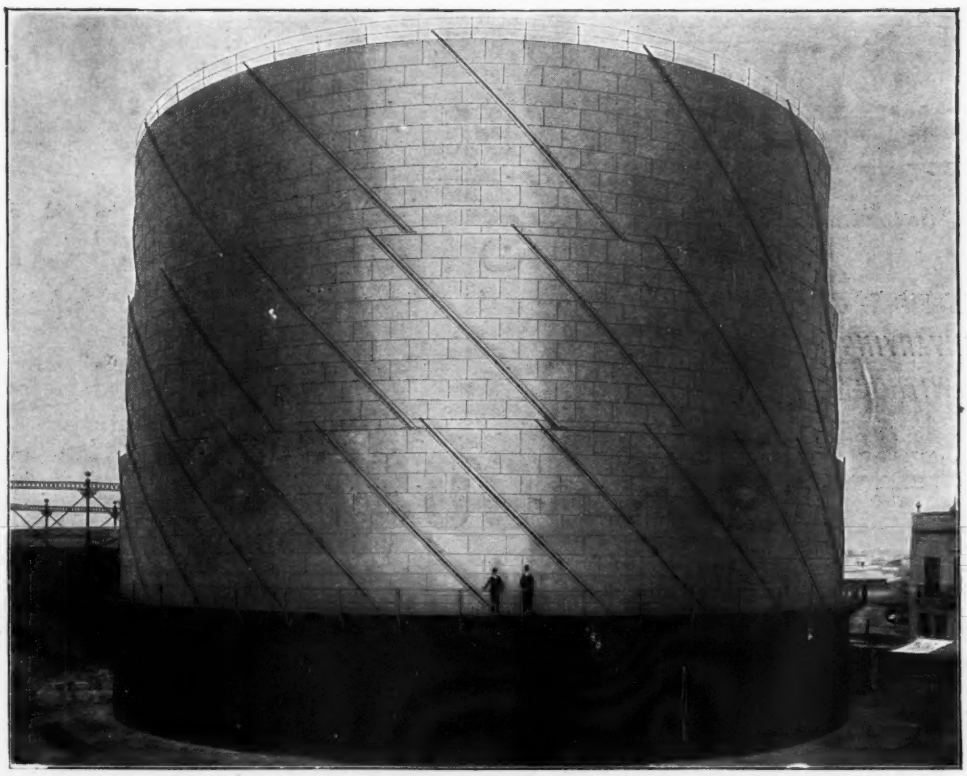

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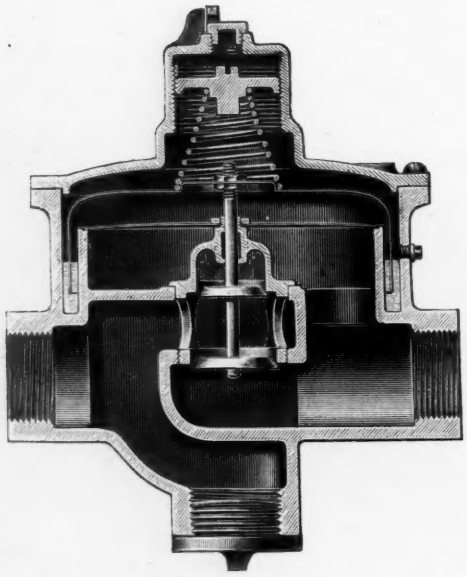

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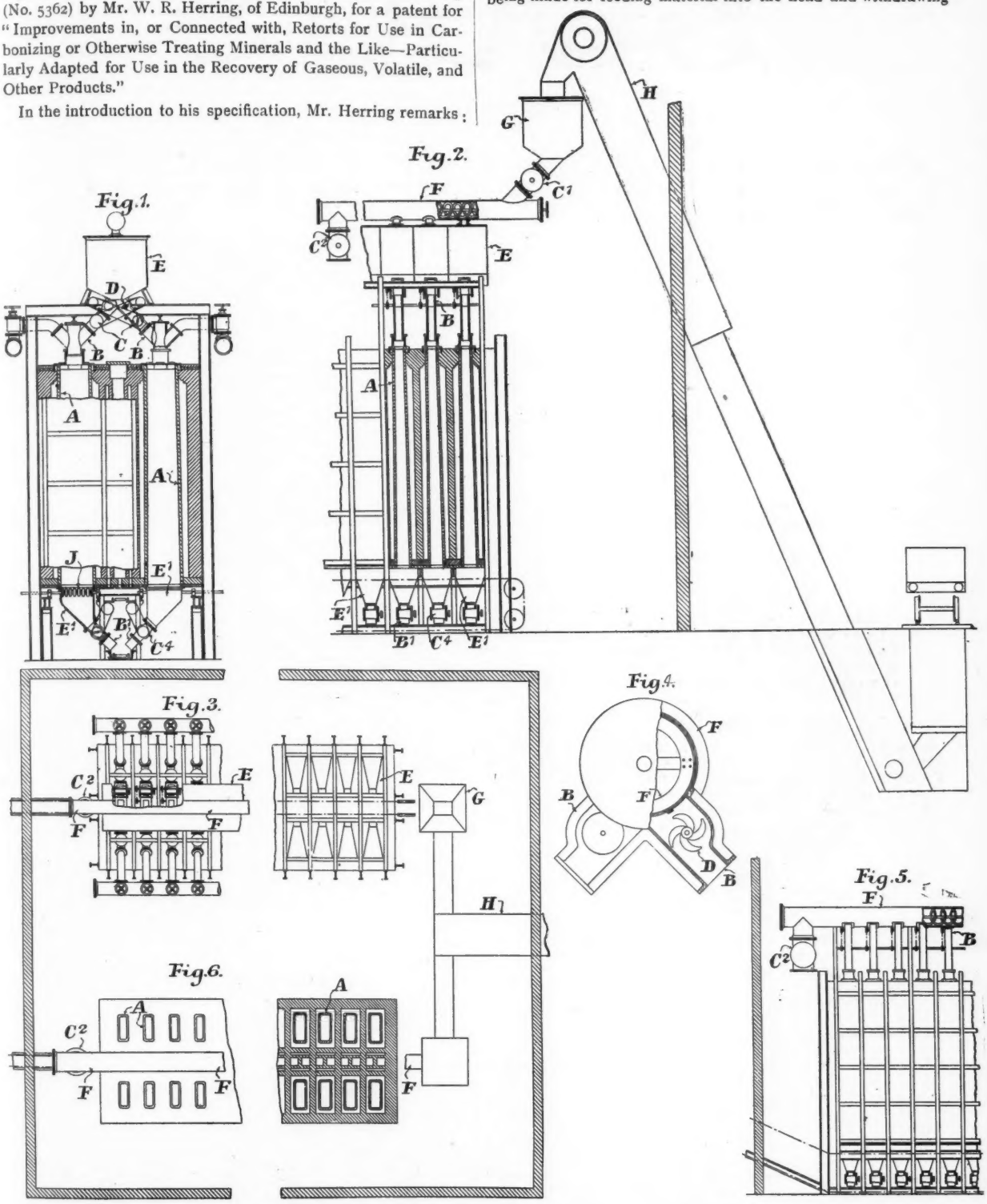
HERRING'S VERTICAL RETORTS.

Last week, the Patent Office issued the specification left on Sept. 4 last in connection with an application made on March 5 (No. 5362) by Mr. W. R. Herring, of Edinburgh, for a patent for "Improvements in, or Connected with, Retorts for Use in Carbonizing or Otherwise Treating Minerals and the Like—Particularly Adapted for Use in the Recovery of Gaseous, Volatile, and Other Products."

In the introduction to his specification, Mr. Herring remarks: For the purpose of carbonizing minerals, it has been proposed to use retorts arranged vertically or inclined to such a degree that their contained charges tend to gravitate downwards. In practice, retorts of this character are worked fully charged; provision being made for feeding material into the head and withdrawing

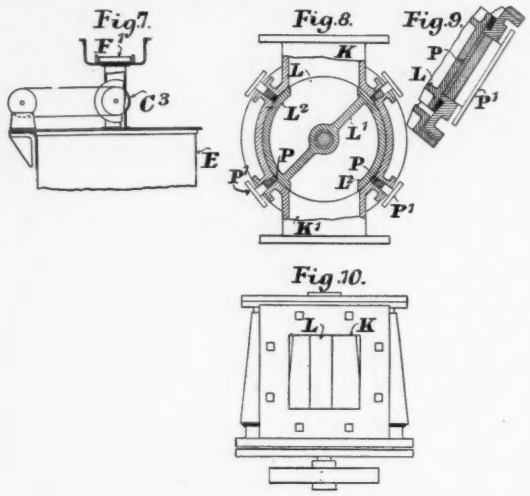


the carbonized material from the foot—permanent closure means being provided, which enable the feed and discharge to be effected without permitting air to enter or volatile products of distillation to escape. It has also been proposed to withdraw the products of distillation by means of an exhauster—a reduced pressure being thereby produced within the retort. Further, for the purpose of supporting a charge of shale or other oil-yielding mineral within a retort, and for withdrawing refuse, it has been proposed to provide two rotary shafts, positioned directly beneath the body of the charge, furnished with radial arms; the inner arms of the two shafts overlapping one another, and the outer ones extending towards the inner side faces of the base of the retort. The object of this invention, which relates to improvements in, or connected with, feeding and discharging apparatus for gravitation retorts of the closed type (particularly adapted for use under working conditions involving a vacuum or comparatively low internal pressure), is to provide means for maintaining a permanent dry seal or closure at the head and base of the retort, associated with apparatus for regulating the supply of material to the closure device at the head of the retort, and means for supporting the charge within the retort at the base.

Fig. 1 is a cross sectional view, fig. 2 is a sectional side elevation, and fig. 3 shows, in sectional plan views, a battery of retorts. Fig. 4 is a cross sectional view of a conveyor. Fig. 5 is a part sectional elevation, and fig. 6 shows, in part sectional plan views, a battery of retorts and modified form of conveyor. Fig. 7 is a cross sectional view of a hopper furnished with a conveyor and closed apparatus. Fig. 8 is a cross sectional view, fig. 9 is a

longitudinal section of a part, and fig. 10 is a plan of the closure apparatus.

The head of the retort A is provided with a delivery shoot B comprising the closure apparatus C, which is adapted to maintain the shoot sealed while permitting material to pass through it, associated with feed-controlling apparatus D for regulating the supply of material in accordance with the capacity of the closure apparatus. For supplying material to retorts arranged in pairs (as figs. 1, 2, and 3), a hopper E may be employed having its base



connected to the head of two delivery shoots B provided for serving the retorts; or (as figs. 4, 5, and 6) a conveyor F, of the helical type, may be arranged to deliver its supply direct into the shoots. In some cases, a sealed hopper, or sealed conveyor, may be employed deriving a supply of material through a supply way comprising closure apparatus, associated, if necessary, with feed-controlling apparatus. For example, a conveyor F (fig. 4) may be fitted to a battery of retorts (as figs. 5 and 6) and (as fig. 2) be furnished with feed closure apparatus C^1 at its head, and with discharge closure apparatus C^2 at its terminal end; the latter being provided in order to permit any excess of material which may be conveyed beyond the shoots B to be discharged without affecting the sealing. Or a sealed conveyor of this description may be associated with a series of hoppers E (as figs. 2 and 3), or (as fig. 7) the supply way of a hopper E may be furnished with closure apparatus C^3 associated with a sealed conveyor, or be provided with an open conveyor F^1 of the chain scraper bar type. For delivering material to a conveyor (as fig. 2), a main supply hopper G may be provided in conjunction with an elevator H.

In the construction of closure apparatus illustrated in figs. 8, 9, and 10, a casing is provided having an upper port K and a lower port K^1, constituting tubular extensions of the casing, arranged to form part of a delivery or discharge shoot. The casing is fitted with a hollow cylindrical valve L, divided into pockets and with mouths which, in the rotation of the valve, are adapted to be presented to the upper port K for charging and to the lower port K^1 for discharging; the body of the valve cutting off connection between the upper and the lower part of the shoot. The valve L is interiorally divided by a diaphragm L^1, which extends across the interior and is formed with peripheral portions L^2, which extend from opposite faces of the diaphragm arranged to project in the direction of rotation.

With the object of reducing leakage, provision is made for automatically compensating for wear. For example, the casing and the body of the valve may be correspondingly tapered, and means be introduced tending to force the valve into its seating, which may conveniently comprise springs located between a cover and the head of the valve (the force of the springs being regulated by adjusting the cover); or springs may be located between a ring and the head of the valve—the ring being made capable of adjustment by providing a sliding sleeve for regulating the force exerted. As illustrated in figs. 8 and 9, longitudinal packing-pieces P are provided, arranged to be kept in peripheral contact with the valve by a longitudinal gland P^1, or the packing may be carried by the valve, and be kept in contact with the casing by a longitudinal gland. By providing the casing of a valve with longitudinal packing-pieces in this manner, the path on the periphery of the valve swept by the ports may be recessed so that a clearance is produced between the valve and the surrounding casing; the longitudinal packing strips closing the annular passage so produced.

The feed controller (fig. 1) consists of a rotary toothed wheel D arranged in, or adjacent to, the head of the shoot and located at a distance above the closure apparatus C to be fed, adapted when at rest to check the flow of material, and when rotated to permit material to flow at a rate regulated by the speed of rotation of the controller, for which purpose the controller and closure apparatus may be geared to work together.

The means for supporting the charge within the retort and withdrawing carbonized material comprise two rotary shafts (having radial arms of material length) positioned approximately beneath the side faces of the retort, and having complementary arms arranged in radial pairs adapted to be set so as to extend laterally across the bottom of the retort, so that presented arms extending between the two shafts form a support for the central part of the charge, and, when rotated in opposite directions so that the arms in the upper path of travel move towards one another, descend with the part of the charge supported on their surface—the following pair of arms in passing into the horizontal position closing the central passage temporarily opened by the receding arms, and in operation act upon, and break up, the material enclosed between the advancing arms, the size to which the material is broken being capable of regulation according to the position, size, and number of arms with which the shafts are provided.

The patentee's claims are: 1. A retort having a delivery shoot at its head, comprising permanent dry closure apparatus associated with means for controlling the feed to the closure apparatus, the foot of the retort being provided with a hopper having a discharge shoot fitted with permanent closure apparatus associated with a supporting base. 2. A retort furnished with a feed hopper or conveyor. 3. A retort furnished with a sealed feed hopper or sealed conveyor. 4. Apparatus characterized by the closure apparatus comprising a casing having an upper port and a lower port constituting tubular extensions of the casing and fitted with a hollow rotary valve divided into pockets; the casing and body of the valve, or the ends, being correspondingly tapered, in conjunction with springs tending to force the valve into its seating for automatically compensating for wear. 5. Apparatus characterized by the feed controller comprising a rotary toothed wheel arranged in, or adjacent to, the head of a delivery shoot. 6. Apparatus characterized by the supporting base comprising two shafts, positioned approximately beneath the side faces of the retort, furnished with radial arms adapted to be presented in radial pairs extending laterally across the base of the retort.

VERTICAL RETORTS & CHAMBERS IN GERMANY.

A Bradford Report.

A Sub-Committee of the Gas Committee of the Bradford Corporation, who recently visited several of the most important works in Germany where vertical retorts and chamber settings are in operation, have presented the following report on the matter to the Gas Committee. The report is signed by the Chairman of the Gas Committee, Mr. Horace Geldard.

Introduction.

During recent years, the attention of those responsible for the administration of gas undertakings has been increasingly given to the study and improvement of the methods of carbonization of coal, which is, and must always of necessity be, the most important section, economically considered, of their business. For many years, while gas enjoyed practically a monopoly of lighting and heating, horizontal retorts were almost universally adopted; being charged by hand with either shovel or scoop. The various competitors that gas had to contend with, and the necessity for cheaper production, led to the introduction of machinery for charging and drawing the retorts, as well as for conveying the hot coke away to the coke-yards. Retorts placed at an angle of about 40° have been adopted in many works; but having many drawbacks when coals with varying physical properties have to be used, they have not been universally approved.

For some time past, gas engineers in Germany have been developing the use of vertical retorts and chamber carbonizing settings with excellent results. The earlier difficulties—such as irregular heating and the leakage caused by the failure of the brickwork to withstand the more intense heats required—appear to have been practically overcome. Both of these systems are now rapidly extending throughout Germany. In other parts of the Continent, various installations have been visited and examined by gas engineers and directors from all the important towns in this country.

In view of the extensions and reconstructions of some of the Bradford Gas-Works which must be carried out in the near future, it was decided that the Sub-Committee should visit several of the most important works in Germany where the new systems of carbonization were in operation. Opportunity was taken at the same time to inspect different types of improved street lighting.

Dessau Vertical Retorts at Berlin.

By the courtesy of the Directors and Engineers of the Imperial Continental Gas Association, who own several of the Berlin Gas-Works, we visited the principal works—Oberspree, Mariendorf, Holzmarktstrasse, and Weissensee. We were afforded every facility for examining the plant and working arrangements.

In 1907, the Imperial Continental Gas Association erected 216 vertical retorts at their Oberspree and Mariendorf works, and 168 more in 1908; also 98 at their Weissensee and Holzmarktstrasse works. Nearly all these were in operation at the time of our visit; and we were informed that no more horizontal retorts would be erected by the Association.

The retorts, which taper from 22 in. by 9 in. at the top to 27 in.

by 14 in. at the bottom, are fixed twelve in a setting heated by one producer furnace. They are 16 ft. 6 in. high; the total height of the bench from the floor level being about 25 feet, and the width 17 feet. The coal is emptied from railway trucks into hoppers below the ground, and is then elevated and conveyed mechanically into bunkers placed above the retort-benches. The coal for charging is then allowed to fall from the overhead bunkers into light measuring chambers running on overhead rails. These are easily pulled along over the particular retort to be charged.

The operations of emptying and charging the retorts were very simple and easy. The hot coke was discharged through counterbalanced gas-tight doors at the bottom, which were opened by simply pulling a lever and turning a handle. The coke then dropped down a shoot on to a conveyor at the side of the bench, and after passing under a water shower was carried to the elevators and coke-heaps outside in the yards. A small quantity (about 30 lbs.) of breeze was first dropped into the retort to take up some of the tar settling at the bottom. This breeze, after a second carbonization, became good coke. One movement of a lever then allowed the measured charge of 11½ to 12 cwt. of small coal to fall into the retort. A mixture of Durham and Silesian coal—which is much inferior to the average Yorkshire coal—was being used.

The retorts were easily drawn and charged by two men, one above and one below, at the rate of 45 seconds each. The charges in the retorts were being carbonized for ten hours in the ordinary way, after which a small quantity of steam was passed into the coke for two hours, producing a certain amount of water gas, at the same time expelling the last traces of the volatile hydrocarbon gases still remaining in the retort.

We were much impressed by the small number of men employed in the retort-houses. The furnaces are large, and capable of running for six to eight hours without attention. The other work was arranged so that all the drawing and charging of retorts could be done during 16 out of the 24 hours. Two shifts of men of eight hours each were therefore only necessary in the retort-houses. We are agreed that the manual work itself was much easier than with our ordinary hand stoking.

The actual production of gas per man employed in the retort-houses varied from 270,000 to 310,000 cubic feet per shift. In Bradford, it is less than 25,000 feet with hand stoking at Valley Road, and under 33,000 feet with machine stoking at Birkshall.

The retort-houses were clean, well ventilated, and lofty. Vertical retorts do not require such substantial and expensive buildings as are usually found in this country.

The average production of gas per ton of coal when using steam was 13,700 cubic feet of 11¾-candle power, or without steam 11,300 cubic feet of gas of 15¾-candle power. In Bradford, with better coal, we only obtain 10,230 cubic feet of 17-candle gas.

In Berlin, a low-power gas is all that is required, as practically all gas lighting is incandescent; flat-flames being seldom seen. It being, therefore, more economical, 10-candle gas is supplied; and the city is admittedly the best lighted in the world.

The coke made in the verticals was harder, larger, and of better quality; while the quantity was greater owing to the small proportion of breeze produced. The tar was thinner, and of better value. There was also an increase in the quantity of ammonia produced. Another important advantage was the almost entire absence of naphthalene, which is a source of much trouble in most gas-works.

The total cost of all the retort-house labour on the verticals was stated by the engineers to be less than 5d. per ton of coal carbonized. Even this figure would be reduced when more settings are in operation. This cost in Bradford is 2s. 8·98d., or more than six times as much.

At one of the Berlin works, where just half the old horizontal retorts had been replaced by verticals, both sections of approximately equal gas-producing capacity were at work. Seventeen men in all were employed on the horizontals, and two men on the verticals.

The heating of the retorts appeared very good and regular; and the work generally seemed to be carried on with ease and comfort. During the short time occupied in charging the retorts, there was certainly a quantity of smoke and coal dust on the top of the benches; but much of this was evidently due to the German coal, which is much dirtier than Yorkshire coal.

Dessau Vertical Retorts at Cologne.

At Cologne, we visited the Ehrenfeld Gas-Works, where 240 vertical retorts of the Dessau type were in use. The general arrangements were very similar to those in Berlin.

At these works, the Director informed us that the results obtained from the verticals were so much better than could be got from horizontals, that they intended to pull down a retort-house containing nearly new benches of horizontal retorts.

Munich Chamber-Settings.

At Munich, we made a very thorough examination of the chamber-settings at the old gas-works at Kirchstein, also at the magnificent new works at Moosach. We were conducted over the works by the Director, the Engineer, and the London representative of the Munich Chamber Syndicate.

At Kirchstein, there were five settings containing fifteen chambers altogether. These had been at work for three years, and appeared to be still in excellent condition. Each of these chambers was charged with 3¼ tons of coal. The charging was very rapid—only taking 40 seconds. The whole of the heavy work was done mechanically; and all the men had to do was to open doors, push along the travelling shoots, pull the levers, and allow the measured quantity of coal to fall into the chamber.

The charge of coal during the carbonizing period of 24 hours was kept in the chamber by means of heavy counterbalanced gas-tight doors placed vertically at the bottom of the chambers. These were opened mechanically, when the 2 tons of coke fell out into a large cooling tower. The chief purpose of this was for conducting the large volume of steam above the level of the buildings. The coke, after slaking, passed into a semicircular trough running the length of the installation, from which it was picked up by a travelling crane and placed where required in the yard or hoppers for filling carts or waggons. The coke produced was hard, bright, and of excellent appearance. It would certainly fetch a higher price for manufacturing purposes than our ordinary soft coke, but might not prove quite as suitable for domestic use.

In the new works at Moosach, the chambers are larger; taking a charge of 6½ tons of coal each, or 19½ tons per setting. They are 28 ft. 6 in. long, 7 ft. 6 in. high, and 22 to 24 inches wide. The inclination of the bottom is about 36° with the horizontal. The ease with which the whole of the operations at the Munich Gas-Works were carried out was very striking.

All the charging and discharging was done during the daytime; only firemen being needed at night to feed the producer furnaces with coke. The amount of labour required was very little, and therefore the cost was low—being less than 4d. per ton of coal used, as against our cost of eight times this figure. The heat of the chambers was good and regular, the tar thin, and no trouble appears to be caused by pitch, naphthalene, or choked pipes.

The yield of gas with German coal was from 12,000 to 12,500 cubic feet of about 12-candle gas; but tests made in similar chambers at Hamburg with Durham coal gave 12,400 cubic feet of 580 B.Th.U. calorific power—or about 16-candle power.

Both the vertical retorts and chamber-settings have been subjected to exhaustive trials by a Committee of the German Association of Gas and Water Engineers.

Work being Done in this Country.

The rapid advance which has been made with vertical retorts and chambers, and the excellent working results obtained, together with the fact that the system is being extended in almost every gas-works where it has been tried, furnished sufficient reasons to warrant us in believing that very large economies would certainly result from adopting the process in Bradford.

We desire to point out that there are several other systems being developed in England and Scotland at the present time—notably the Woodall-Duckham process of continuous carbonization now working at Bournemouth, London, Burnley, &c.; and the Glover-West system (also continuous) in use at St. Helens.

The working results of these systems are very good; 12,400 cubic feet of 16-candle gas per ton of unscreened Yorkshire coal being obtained by Dr. Colman at St. Helens, while 14,000 feet of 14-candle gas have been produced at Bournemouth from mixed Somerset and Yorkshire coal.

An important advantage in both of the continuous processes is that one quality of gas can be uniformly maintained; while with chambers working 24-hour charges we should be obliged to make provision for the varying qualities getting properly mixed. Another advantage is that very little smoke is given off—an important feature in a town gas-works. The St. Helens plant also takes up less ground space for the same production of gas than any other system.

The Dessau installation at Sunderland has already been at work for several months. It is very successful; producing from Durham coal 12,000 feet of 17½-candle gas (calorific power equal to 568 B.Th.U.), with eleven-hour charges, and no steaming.

The Dessau Company have introduced improvements during the last two months at Mariendorf. The three retorts in a row are charged together by one operation; a divided shoot being used. The gas now made per man per shift when working English coal is 388,000 cubic feet; and the cost of carbonizing wages only amounts to 0·18d. per 1000 cubic feet.

Working Results Compared.

For the purpose of comparison, the working results obtained with the various installations, as well as our latest Bradford figures, are tabulated.

Type of Setting.	Gas per Ton. Cubic Feet.	Candle Power.	Coal per Charge. Cwt.	Time in Charging. Seconds.	Gas made per Man per Shift. Thousands.	Wages per Ton of Coal. Pence.
Bradford hand stoked	10,440	17	2¾	120	25	35·51
Bradford machine .	10,622	17	3	45	33	27·81
Munich chambers .	12,300	12	65	40	—	4·0
,, new . .	—	—	130	—	—	—
Berlin verticals . .	11,300	15¾	11½	30	285	5·0
,, new . . .	13,430	10	21½	—	388	2·5
Sunderland verticals	12,028	17½	9	—	—	—
St. Helens (Glover-West)	12,400	16	60 per day	—	290	2·75
Bournemouth (Woodall-Duckham . .	14,000	14	50 per day	—	—	—

NOTE.—Different classes of coal are used in the different installations. The total value of the residuals produced per ton of coal by the vertical retorts or chambers is greater than by our system of working horizontals.

Conclusions.

It is impossibie to say what the cost of wear and tear of vertical retorts would be; but as some of those in Berlin have already been working longer than the average life of our Bradford retorts, with very little having to be spent on them for repairs, it seems probable that the cost would not be serious. As the machinery is simpler, the cost of maintenance should be less than that of the machinery for the ordinary horizontal types.

As to capital cost, this would depend largely upon the site available, and the size of the installation; but there is not the slightest doubt that, if we decide to have a plant erected in place of some of the existing retorts at the Valley Road or Thornton Road works, the improved results obtained would show a large saving to the Corporation after paying all charges of interest and sinking fund.

The Sub-Committee, being anxious to have the best system, are not yet prepared to advise as to which one should be adopted; but in view of the great importance of the matter, they strongly recommend that the whole of the Gas Committee should visit the various installations working in this country at Sunderland, St. Helens, Bournemouth, and Kensal Green, as early as possible.

Berlin Street Lighting.

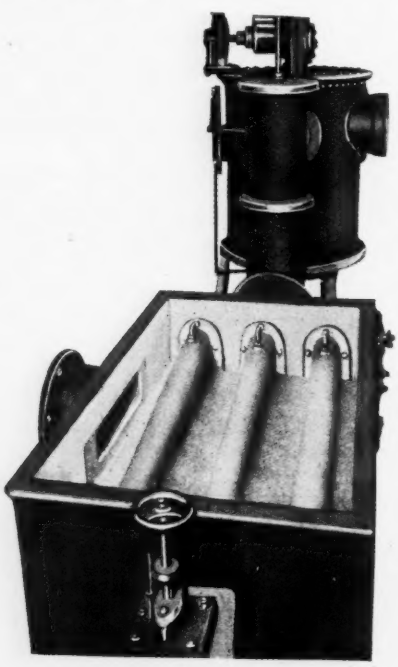
As far as time allowed, we carefully inspected the lighting of the Berlin streets.

In the main thoroughfares, high-pressure inverted gas-lamps having two or three burners are used; each burner giving a light of 1300 candles. The lamps are 19 feet high and about 35 yards apart. The lighting effect was extremely brilliant, though the cost per mile of street is necessarily high in comparison with the low cost in Bradford. The Berlin Municipal Council spent £50,000 per year for the last three years on replacing their old lamps (both gas and electric) with these new gas-lamps. They have decided to continue these improvements at the same rate for the next four years.

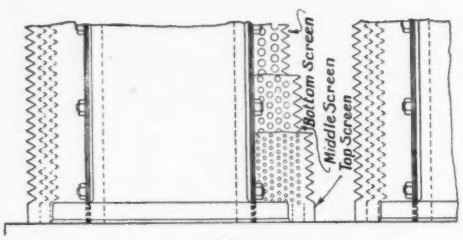
We were informed that in four years, there would be no electric public street-lamps left in Berlin.

IMPROVED MULTIPLE AMMONIA WASHER.

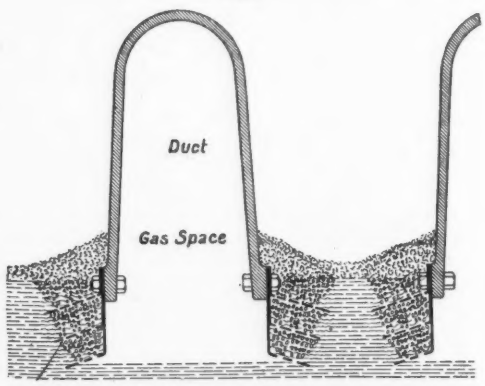
The issue of the "American Gaslight Journal" for the 21st ult. contains an illustrated description, specially communicated, of an improved multiple ammonia washer manufactured by the Western Gas Construction Company, of Fort Wayne (Ind.), and used extensively in the production of both water gas and oil gas, as well as in connection with the Holmes rotary scrubbers, which are also manufactured by the Company. The following are some particulars of the apparatus.



It may be first of all remarked that the ordinary type of multiple ammonia washer, which aims to perform the purification of gas from tar and a considerable proportion of its ammonia, by subdividing the stream of gas into minute streams or bubbles, through two or more stages, accomplishes this object by forcing the gas through channels which are closed with perforated plates. When the perforations become clogged with tar, lampblack, or naphthalene, the passage of the gas through the washer is effected only by a considerable increase in back-pressure; and the process of cleaning the perforations is a laborious and expensive one. It was with the thought and object of obviating these difficulties that the type of washer described and illustrated was designed. Its special feature consists in placing the perforated plates one above the other; each plate extending slightly farther than the one below it, and all being bent to a common angle, sufficient to retain a pocket of gas proportional to the capacity of the washer, and leaving an absolutely free and clear opening between the ducts. The edges of the perforated plates are serrated, and the perforations diminish in size and increase in number from the bottom plate up.



Plan.



Sectional Elevation.

It is at once apparent that the gas is thoroughly subdivided and washed in as many successive stages as there are perforated plates, three of which are found to be sufficient in ordinary practice. In case the washer should be overloaded beyond its rated capacity, or should some or all of the perforations in any of the plates become clogged up, there is practically no resultant back-pressure; the gas passing at the serrated edges of the plates, and being caught by the plate above on account of its projection beyond the edge of the first plate. The passage around the serrated edges has a considerable washing effect, although, of course, not so much as when the gas passes through the perforations. At no time can a stoppage occur in the washer or excessive back-pressure be experienced; and at no time does the gas receive less than three stages of washing, even if all the perforations became clogged up, which is extremely unlikely. In case they should do so, the plates are easily accessible for cleaning, and can be steamed in position by means of a bent steam-pipe. The expense of construction and repairs is very materially decreased, since the plates are simply bent to the proper angle, and bolted (the three together) to the ducts without the necessity of expensive and careful forming in frames and enclosed spaces.

The peculiar construction of the washer afforded an excellent opportunity of ascertaining definitely, by experiment, its maximum capacity per lineal foot of ducts; and these experiments were accordingly made. Air was, of course, used for them; and the results obtained were corrected for gas at a density of ·4, ·5, and ·6 sp. gr. The washer was 3 ft. by 5 ft. by 2 ft., and air was furnished by a No. 6 Sturtevant blower driven by a 20 H.P. turbine; the amount of air being controlled by a gate-valve in the air-delivery line. The air was sent first through a new model Pelouze and Audouin condenser, in order to obtain practical working conditions; and the quantity of air delivered to the washer was determined by Pitot tube readings in the ordinary way, The maximum capacity of the washer was decided by observation of the contained water and the escaping air. In this manner very accurate information, such as would be impossible with enclosed escapes, was obtained regarding the capacity of the ducts.

It is claimed for the washer that it not only removes the last traces of tar and lampblack, but, in connection with the Holmes scrubber, absorbes from 25 to 50 per cent. of the ammonia contained in coal gas. A double-deck washer of this type, having a capacity of 8 million cubic per day, was specially constructed some months ago for the Pacific Gas and Electric Company, of Oakland (Cal.). It was 10 ft. by 8 ft., and 5 ft. 3 in. high, with 24-inch inlet and outlet connections divided into pairs 20 inches in diameter.

The late Mr. H. Spencer Hughes, one of the Directors of the Bromley Gas Company, left £29,227.

MANCHESTER JUNIOR GAS ASSOCIATION.

Annual Meeting.

The Eleventh Annual Meeting of the Association was held on Saturday evening, at the Exchange Hotel, Manchester. Prior to the business being entered upon, members and invited guests had "high tea" with Mr. F. Thorp, the President-Elect.

At the subsequent meeting, Mr. JAMES TAYLOR (Mossley), the President, occupied the chair; and those present included Professor Harold B. Dixon, M.A., F.R.S., of the Victoria University, Manchester, Mr. H. Kendrick (Stretford), President of the Manchester District Institution of Gas Engineers, Mr. T. Duxbury (Oldham), Past-President of that organization, Mr. W. Whatmough (Heywood), the Hon. Secretary, Mr. T. B. Ball (Rochdale), Mr. S. W. Shepherd, President of the Yorkshire Junior Gas Association, and Mr. James Hill, Manager of the Bradford Road Gas-Works, Manchester.

THE ANNUAL REPORT.

In their annual report, the Council stated that the membership of the Association had been well maintained. On April 3 last year, the number of members on the books was 157; and during the twelve months 14 new members had been elected, while 14 had retired—leaving the present membership as it was at the commencement of the year. Two very successful "coffee meetings" had been held, and also a debate with the Manchester Students' Section of Electrical Engineers on "Gas *v.* Electricity for the Generation of Heat and Power." The Association desired to express their indebtedness to Professor Dixon for the lectures he gave to members at the Victoria University—one on the "Chemistry of Flame," and the other "Some Theories of Combustion of Gases"—and also for his kind interest in the Association, which had made possible a valuable connection between the Manchester University and the Junior Association. The connection between the Association and the Manchester District Institution of Gas Engineers, whereby each was represented on the Council of the other, had been continued; the rules of the respective Associations having been so amended as to admit of this. Thanks were tendered to the authors of papers, and to Mr. J. Alsop, who had carried out the duties of the Hon. Secretaryship with satisfaction to the Council and credit to himself.

The PRESIDENT, in moving the adoption of the report, mentioned that it was with regret that they had received the resignation, owing to his distance from Manchester, of Mr. Mottram, of Ossett, one of the original members of the Association. A point for gratification was that they had not, since the formation of the Association, lost a single member by death. He desired to acknowledge on behalf of the Association the kindly feeling shown by the Manchester District Institution of Gas Engineers to them, and the willingness always shown by the seniors to further the interests of the juniors in gas affairs generally. They had with them that night a number of gentlemen who had contributed to their education during the year, by inviting the members to visit their works; and he desired to say that on every occasion they received nothing but the most kindly treatment. Everywhere they had been, the engineers had extended to them the greatest courtesy, and shown willingness to explain the working of their respective plants and specialities. In conclusion, he paid a warm tribute to Mr. Alsop, for the way he had discharged his work as Hon. Secretary.

Mr. R. H. GINMAN seconded the resolution, which was carried without discussion.

The balance-sheet was approved on the motion of the PRESIDENT, seconded by Mr. T. W. SMITH.

ELECTION OF OFFICERS.

The ballot for the Vice-Presidency resulted in Mr. A. L. Holton securing the largest number of votes.

Mr. D. V. HOLLINGWORTH, F.C.S., who had also been nominated, at once, on the result being announced, moved the election of Mr. Holton to the post.

Mr. ALSOP, in seconding, said Mr. Holton well deserved the honour, in recognition of his work on behalf of the Association in the past.

The resolution was carried unanimously.

Mr. HOLTON, acknowledging the compliment, said he greatly appreciated the action of Mr. Hollingworth in so kindly moving his election as Vice-President.

The following other appointments were made:

Hon. Secretary.—Mr. J. Alsop.
Hon. Treasurer.—Mr. R. H. Garlick.
Auditor.—Mr. A. Berry.
Members of the Council.—Messrs. W. Buckley, D. V. Hollingworth, S. Carter, and A. Hodgson.

On the motion of Mr. W. L. HEALD, seconded by Mr. A. BERRY, a vote of thanks was accorded the retiring officials—reference being made to the excellence of the programme arranged for the past session.

Mr. TAYLOR, in asking the new President to take the chair, said that in Mr. Thorp they had a gentleman eminently fitted for the position he was now called upon to occupy. He could not vacate the office of President without expressing his appreciation of the kindness and assistance he had received from the members. He was confident Mr. Thorp would have the same support.

Mr. THORP, who, on taking the chair, had an enthusiastic reception, moved a hearty vote of thanks to Mr. Taylor for his services as President. He said Mr. Taylor not only handed over the reins of office untarnished, but burnished through his skilful handling.

Mr. J. NICHOLL seconded the motion; and in commenting upon the excellence of the syllabus of the past session from an educational point of view, expressed the hope that the University lectures would be continued in the coming session.

The resolution having been duly carried, Mr. TAYLOR suitably responded.

Mr. THORP then proceeded to deliver his

INAUGURAL ADDRESS.

The address opened with a recognition by the President of the honour conferred upon him, in view of the position he held among the members by his election, and an expression of his sincere thanks for the confidence placed in him. He assured them that it would be his earnest endeavour to maintain the dignity of the office he had been chosen to fill, which had been so worthily upheld by his predecessors. He acknowledged the ability of the Treasurer and Secretary of the Association (Messrs. Garlick and Alsop), and the loyalty of the Council; and said that it only remained for the members generally to assist in making the session on which they were entering a remarkable one. He appealed to them to assist in this grand endeavour. He said he could not, as other of their Presidents had done, give them experiences on his own gas-works; but he thought his address should have a personal note in it. Being a trader, it was somewhat difficult to do this without treading on dangerous ground; but he would, with their permission, discuss a few of the more important and interesting points bearing upon the measurement of gas. He then proposed to devote a little time to the educational problem in connection with the Association; and he trusted they would find some way of taking advantage of a very generous offer which had been made by Professor Dixon on behalf of the Manchester University.

Proceeding to deal with his first subject, the President said it was originally his intention to trace the evolution of the gas-meter from the time of Clegg and Malam to the present day; but he found, on going through the patent records, he had undertaken a task which was impossible of accomplishment, in the limited time at his disposal, with any degree of satisfaction to the members or to himself. He, however, would very shortly review the progress made. He then referred to the patents taken out in connection with gas-meters, the first of which was granted in 1815 to Samuel Clegg. From this year to 1850 (a period of 35 years), 38 patents were taken out; but from 1850 to 1858, some 69 were applied for—showing the increasing importance of correctly measuring gas. The President described, with the help of lantern slides, the early meters of Clegg, Malam, and Crosley, and explained that, as the result of successive alterations, the drum finally assumed something like its present shape. He then referred to the attempts made to keep the water-line constant, and mentioned the Warner and Cowan drum, the Greenall meter, and other modern types of gas-measuring instruments.

Having roughly sketched the history and development of the gas-meter, the President proceeded to indicate a few instances where meters are wrongly used; expressing regret that it is the rule rather than the exception to employ a meter which is too small for the purpose. This part of the address, and the President's remarks on the educational question, are given below.

THE QUESTION OF MEASUREMENT.

I do not wish to go into the merits of any particular meter or system of measurement, as this would be treading on the dangerous ground I mentioned early in my address; but in case any outsider by chance reads the remarks, I wish it to be understood that there is a positive cure for all the ailments I shall mention. In making experiments some time ago on engines and exhausters, we found the flow of gas in the mains varied much more than one would expect from an observation of the pressure-gauge. We carefully tested, by means of a diagrammatic meter, this variation; and the diagram (fig. 1) gives the variation of flow

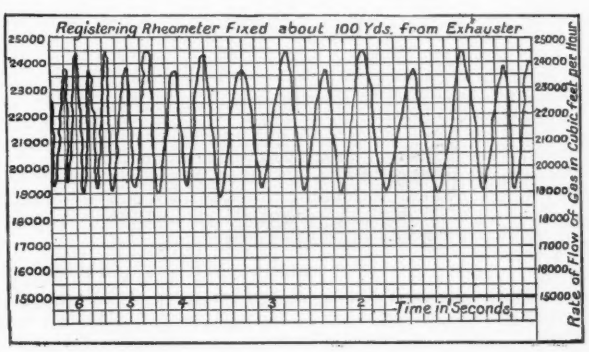


Fig. 1—Diagram of Pulsations from a Two-Bladed Exhauster.

100 yards from the exhauster. It will be noticed that the difference of flow is enormous—viz., 19,000 to 24,000 feet per hour; whereas the pressure-gauge only showed a few tenths variation.

We then examined the case of a gas-engine fitted up with the usual gas-bag supplied by the engine builders. Diagram No. 2 is taken on the main before the gas-bag and at the outlet of the meter. The engine is a new 13 H.P. "National," working very

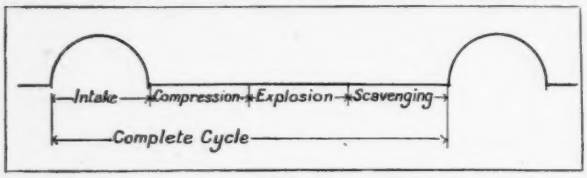


Fig. 2.

well indeed. It will be seen that the quantity varies from 50 to 500 feet per hour, although the actual consumption per hour is only 120 feet at about half-load. Now I find that most gas companies and engine-makers, where deciding the size of meter required, simply multiply the horse power of the engine—*e.g.*, 13 H.P. × 20 = 260 feet per hour, and then say, "A 40-light or a 50-light meter will do." I have seen a 30-light meter used. The meter makers, who naturally want as big a meter as possible installed, give 80 lights for a 13 H.P. engine; and where a proper anti-fluctuator is not used, they are much nearer right than the engine builder. If we examine an engine of the Otto cycle type—most of the engines gas engineers deal with are likely of the single-cylinder Otto type—we get the diagrammatic cycle fig. 3.

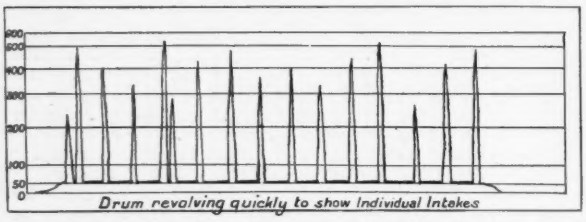


Fig. 3—Thirteen Horse Power Gas-Engine (Otto Cycle), Working at about Half Load; 120 Cubic Feet per Hour.

The cycle is divided into four parts—viz., the intake stroke, the compression, the explosion, the scavenging stroke, and then on to the intake again. If no gas-bag is used, then all the gas is taken from the main in a quarter of the time of the cycle; and really at the middle of the stroke it is taking it at a quicker rate still. But we will neglect this point for a moment. The present gas-bags are often nearly useless, as the diagram shows; so if we say the gas is taken in half of the cycle, we are well within the mark. The engine being a 13 H.P. one, requires (say) 260 feet per hour; but as it takes its gas in half of the cycle, the actual rate of flow through the meter will be at times (say) 260 × 2 = 520 feet per hour. It is taken at this rate whether working at quarter, half, or full load, as a gas-engine takes its quantity at the same rate—the only difference being that it takes it more frequently on a full load than it does on a lighter one. Now it is very obvious that most meters are working at much greater rates than they are made for, although they may not be passing more gas than designed for in the hour. I want to impress upon you the fact that it is the rate per hour you must watch. How does this affect you? I have tested many new meters—some fast, some slow, some correct; but an average one will suffice to show you the importance of this. A 30-light new dry meter, of good make, gave

At its rate per hour	180 feet	. .	correct
	300 ,,	. .	2½ per cent. slow
	400 ,,	. .	7½ per cent. slow
	500 ,,	. .	10 per cent. slow

As the engine takes its gas at the rate of 520 feet per hour, the registration is slow. You now see where you are losing money and racking the meters to pieces by installing them of too small a capacity. That this is not overstating the case will be at once recognized by those who have read Mr. Ellery's address to the Southern District Association, as he gives the results of testing meters on overload as much as 20 per cent. slow. It is important to notice that as the quantity increases, the percentage of error increases; and this is a most serious condition of affairs, as 10 per cent. slow at 10 feet an hour is only a loss of 1 foot, while at 500 feet it is 50 feet per hour. A gas manager would, of course, prefer, I should think, a meter correct; but if it must be slow, then let it be at low quantities, and not at high ones. Irrespective of the pulsations produced in the main, it is therefore absolutely necessary that efficient anti-pulsator governors should be fixed on all gas-engine meters.

I have read with very great interest the Presidential Addresses of the worthy President of the Manchester Senior Association, Mr. Kendrick, and of Mr. Ellery, the President of the Southern Senior Association, to which I have just referred. Mention was made of the passing of gas unregistered by dry meters when by-passes are burning; and their having given publicity to it must be my excuse for mentioning it. The passing of gas unregistered is generally attributed to leaky valves, and I believe very often correctly so. In these days of compressing plants, however, we are approaching American practice; and it is well to look occasionally to what they are experiencing. In a paper read at the American Institute in October, 1909, while I was in America, Mr. Miller, of Philadelphia, gave some of his experiences of meter diaphragms. It is found that compressing produces very dry gas, and this gas extracts the oil from the diaphragms, and very soon allows as much as 5 feet per hour to pass through the diaphragms without registering; and arrangements have had to be devised to keep the diaphragms continuously oiled. I do not wish to go further into this matter, but think that it is a point well worth watching, especially with our present Government methods of testing meters.

TESTING METERS.

Several members have from time to time requested me to describe the testing of meters; but considering my position, I should prefer to refrain from doing so in this address. If some member cares to give us a paper on the subject, I shall be happy to assist him. The question of testing station meters is, however, one which I am often asked about; and some personal experiences may be worth relating. Before proceeding, I should like to refer you to the excellent paper read by Dr. Davidson before the Midland Juniors in December, 1908.* A common practice is to test a station meter by a holder. The danger in testing a meter in this way is not so much in the want of accuracy of calibration of the holder or variation between the temperature of the holder and of the meter, but in the variation of temperature in the holder itself. The really wonderful way in which the gas responds to an increase or diminution of temperature is surprising. One can easily understand the rising and falling of a holder when the sun shines or is obscured by a cloud; but one would hardly be prepared for variations at night. I remember very vividly sitting on a large gasholder for some hours one September night in Copenhagen, taking temperatures at the top and half way down inside the holder, and being surprised at the variation of temperature from, I almost said, minute to minute. At the commencement of the test, it was one of those beautiful nights when one would have preferred to lie down and contemplate the beauty of the heavens, instead of sitting on a gasholder taking temperatures; but before long, thin vapoury clouds came across the sky, and very fine rain occasionally fell. Then, again, all was clear and bright. There was sufficient variation during these changing conditions to upset all tests if we had neglected making corrections.

That a small variation in temperature is not a trivial matter, I will show by an example of a test I made in Stockholm on a large 100,000 cubic feet rotary meter and a 2½ million feet holder. This holder is in a large brick building, to protect it from the great variation of outside temperature they experience in these northern countries in the different seasons. The temperatures were taken at the top and half way down the holder. We commenced the test at 9.30 a.m., and continued until 7.10 p.m. From 9.30 to 3.10 there was a rise of 3·4° C., and from 3.10 to 7.10 a drop of 2·5° C.; the greatest variation being 11.30 to 2 o'clock—viz., 1·8° C. This does not seem much. But let us take an example, and see how it affects us. Gas is going into the meter at (say) 50,000 feet per hour. For 2½ hours the actual gas passing and registered by the meter is therefore 2½ × 50,000 = 125,000 feet. Now take it that the temperature at the meter and holder is the same, but between 11.30 and 2 o'clock there has been a rise in temperature in the holder of 1·8° C. At 11·30 there were 2 million feet in the holder. Adding the amount passed into the holder, we should expect 2,125,000 cubic feet. What was actually found was about 2,147,000 feet, thus showing an increase of 147,000 feet, in place of 125,000 feet. The increased amount that would be shown by the holder without the addition of the new gas would amount to about 12,700 feet; and when we consider that we are only passing 125,000 feet in, it makes the meter apparently 10 per cent. slow. This error would be increased to 100 per cent. if 5000 feet per hour had been passing in place of 50,000 feet. My point is that in testing a meter by a holder a night should be chosen when the temperature varies as little as possible, and the quantity of gas in the holder should be reduced to normal temperature and pressure both at the commencement and the end of the test. I have seen holders go up when we have been taking gas from them, and fall when putting gas into them. I cannot go into detail; but I trust this rough indication of what happens will be of use.

Another thing in testing wet station meters that I think has not received the notice it deserves is the variation in the water-line due to sudden changes in the rate of flow, especially when working near or over the badged rate per hour. You all know the considerable difference in pressure absorbed by the meter at these rates, with consequent change in water-line and variation in measurement if not compensated for. You naturally say, "But we have always water running in and out, and so the water-line is kept constant." Suppose we get a change of water-line of ½ inch, which is often the case at the rates previously mentioned. Consider the size of a 100,000 feet meter, and multiply the area of the drum at the surface of the water by the ½ inch deep, and you have a space capable of holding a large volume of water. Now as the water only trickles in or out of the meter, I leave it to you to imagine how long it will be before the meter is working at its correct water-line, remembering that during this time the meter may be several percentages incorrect. There are, of course, many other points to watch; but my endeavour has been to show where possibilities of error may arise from factors not generally taken into consideration.

* See "JOURNAL," Vol. CIV., p. 764.

EDUCATIONAL MATTERS.

Having examined somewhat briefly the subject of measurement, with, I trust, some benefit, I will now proceed to lay before you some views of the educational problem as it presents itself to your President, and to some, if not all, of the members of your Council. At the onset, I wish to express the thanks of our Association to the authorities responsible for the classes in Gas Engineering, Gas Supply, Gas Analysis, and Gas Manufacture, &c., which have performed, and we trust will continue to perform, a very useful and necessary work. The success of the Leeds Chair of Fuel is very gratifying to the gas industry as a whole, especially as practical results, so dear to the man in the street, have already made themselves manifest; but, unfortunately for Lancashire men, Leeds is in Yorkshire, and many of our members who would dearly like to take advantage of the facilities there offered to increase their knowledge, are prevented by the expense and distance.

In Manchester, we have the Victoria University, and not only the University, but, what is even more important, the Head of the Department of Chemistry and Fuel. Professor Dixon is a gentleman whom we have all very good cause to know and to think of with gratitude for the many kindnesses he has shown to us. I think I may say without fear of contradiction that in Professor Dixon we have the leading authority on the chemistry of flame, the combustion of gases, &c.—in fact, in everything relating to chemical and the physical properties of gases; and it has been a matter of much concern to your Council how to take advantage of the opportunities for increased knowledge that here present themselves. Your Council have given very careful consideration to several schemes, and have appointed Mr. Hollingworth and myself to interview Professor Dixon. We were not only courteously received, but our suggestions met with much more consideration and sympathy than we had dared to anticipate. That there should be a distinct connection between the University and our Association was the first consideration; and the permission to hold our meeting of Jan. 15 at the College marked the beginning of, I hope, a long and useful association with the University. Professor Dixon's admirable lecture further cemented this connection; and I trust the lectures and classes it is proposed to hold in the coming session will definitely bind the gas industry, through this Association, with the Manchester University.

There are very many reasons why this connection is desirable; and one not generally considered, but to me an important one, is the standing this relationship will give to our profession in the eyes of the world. It has always seemed to me that a gas engineer is not looked up to in the same way as a civil or electrical engineer; whereas the educational requirements and technical knowledge demanded of a present-day gas engineer are greater than in almost any other profession. Professor Tilden, when speaking on Professor Meldola's address to the Society of Chemical Industry, referred to the requirements of a chemist; and I have taken the liberty of applying his words to the gas engineer:

> **There was a disposition nowadays to require of the young man taken into industrial chemistry rather too great diversity of accomplishments. It was not necessary only that he should be a skilled chemist, that he should know something about electricity, that he should have sufficient mathematics at command to enable him to tackle any problem in physical chemistry, and also that he should know something of engineering, but he had to study the nature of markets, and how to deal with matters of business. It seemed to him that there could not be rolled into one person a research chemist, a works manager, and a business manager—it was physically and humanly impossible that any such person could ever be found; and the man who was to assist as a scientific chemist in a works must be allowed to devote himself to that department of the business. If he were wanted in the office, that was one thing; but the laboratory was another. It was not fair, and neither human strength nor human life was sufficient to enable a man to undertake all these various functions.**

If this be true of the industrial chemist, how much more so is it true of a gas engineer? The general public do not know this, and do not associate science with gas making. Now a recognition by the Manchester University will go a long way towards changing this; and I trust before long the gas engineer will be looked up to as his abilities deserve.

While all may be agreed as to the desirability of something being done, many may say that it will cost money, and that the Association cannot afford it, especially considering the present state of our balance in hand. Let me say, first of all, that it is not intended to put the members to any greater expense—at least, not at present, as the Association has already been promised a sum nearly sufficient to cover expenses; and we have no doubt we can easily raise the balance. When the manufacturers, gas committees, and directors of gas undertakings in Lancashire see that we are prepared to do our share, we ought not to have any trouble in raising the sum necessary for the good work; for it is not only the individual that benefits by increased facilities for education and research, but the whole of the industry.

When we consider the great importance of the gas industry, the enormous amount of capital invested, and begin to realize that it is one of the principal industries of the country, it is surprising the small amount of interest that has been taken in the higher education of gas engineers and in research work. This lack of interest cannot be laid at the doors of our Technical Journals, as they have repeatedly called attention to the fact, and deplored the small amount of assistance given to educational schemes by gas undertakings. It has seemed to me that the Chair of Fuel at Leeds is the outcome more of a wish to perpetuate the memory of one of the greatest gas engineers and organizers the world has seen, than an actual desire in the first place to found a Chair of Fuel.

Mr. J. W. Helps, of Croydon, the worthy President of the Institution of Gas Engineers, as well as many others, has done exceedingly good work in this direction; but, as in most cases of this kind, the lack of funds has prevented the forward movement to a large degree, and has certainly prevented many taking advantage of the Leeds lectures. I have often wondered at this lack of appreciation of the necessity of higher training, and am driven to the conclusion that it is to a large degree due to the fact that few of the gas undertakings are in the hands of individuals as owners. In the great iron, steel, and allied trades, the captains of industry, having the interest of their industry at heart, have founded scholarships, endowed colleges, and assisted aspiring students in many ways, to the lasting credit of themselves and the good of the great industries they have been connected with. I trust my socialistic friends will excuse me mentioning it; but I feel our industry is suffering from want of individual help, such as the individual capitalist can, and often does, give. I saw a notice in the paper the other day that a soap maker had given £90,000 to a University—oh, for some such help!

Corporation committees have in the past been more concerned in making profits and appropriating them to relieve the rates, and boards of directors in making present-day dividends, than in considering the future of the gas industry. I trust that we shall soon be able to look upon this attitude as a thing of the past, and that when we appeal for assistance we shall find a new state of affairs, and that we shall not only be encouraged by their generosity, but assisted with their advice. The question resolves itself therefore mainly into one of self-help; and our Association, along with the kindred Associations, must move if anything is to be done in our separate districts. Lancashire is without a course of college training for the gas engineer who wishes to go beyond the honours stage of gas engineering; and it is a reproach to this great county. We have also in Lancashire the foremost firms in meter making, gas machinery, and apparatus manufacturing, the chief coal companies, and also a very large number of gas undertakings. It will be a lasting reproach if Lancashire cannot at least arrange for some evening students' scholarships and a series of lectures at the Manchester University, where students who are unable to avail themselves of the advantages offered at Leeds can have the benefit of Professor Dixon's guidance while working in the splendidly-equipped laboratories, &c.

The College authorities, through Professor Dixon, have very generously offered their help; and I want this meeting to authorize the Council to appoint a Sub-Committee to go thoroughly into the scheme, interview the Senior Association, the Technical Press, leading Lancashire manufacturers, and gas companies, with a view to providing a fund for the furtherance of education in gas matters. It is our intention to begin very modestly; and if we can send three, or assist six, students to attend the College one or two nights a week in the coming winter session, and to hold a special series of lectures given by the most eminent men in the scientific and gas world on subjects covering the general work of a gas engineer, I for one shall be satisfied. This is the beginning only of our scheme; and I am sure that, once we commence and the results are made manifest, the larger scheme will succeed our modest one as the day follows the night. I have not time to show how all would benefit, from the humblest workman to the chairman of the gas company, or from the junior pupil to the finance committee of a corporation. Suffice it to say that the elementary student would benefit in the first place by the fact that his teacher would have the opportunity of increasing his own knowledge, with the corresponding advantage of being able to more clearly demonstrate to the elementary student, through attending the college course, and all members, either of the junior or senior associations, would have equal opportunity of benefiting by the lectures.

Many people look askance at college training, and, personally, I have little faith myself in purely college work. But our men would be those who had been engaged for three years at least in practical work—men, therefore, who know where they are deficient and what will be of the greater help. What I should like to see would be a working arrangement between the University and the gas-works where a combination of the qualities of a professor and an engineer could produce results impossible by either of them working independently. Why should not an engineer use the laboratories at a university for working out, along with a professor, ideas impossible of success in the works alone? And why should not the professor or a research student, either in the physics or chemical department, not necessarily a gas man, work in conjunction with an engineer on some practical problem on a gas-works? It is often a matter of difficulty for a research student to decide upon a course of research. For example, a student in biology, for want of something better, spends a year or more on investigating the functions of a parasite on a rotifer.

Look at the possibilities a university connection with a gas-works opens out. We have (say) a difficulty on the works which requires a lengthy investigation—the engineer has not time to devote to it, and his assistants have their routine work, or leave before an investigation is completed. The engineer and the professor come together. The works are open to the professor, and he can direct several research students upon this work, tabulate the

results, and, when the course of one set of students is finished, the new students can continue the work under the guidance of the professor and engineer, who have carefully noted the results of the first set of investigators. I am in hopes that we shall be able to assist, by way of scholarship or grant, several students to take up evening research work, and that the results of their labours will be embodied in communications to our Society.

I should here like to quote from Mr. Thomas Newbigging's Presidential Address to the Society of British Gas Industries, where he said: "Depend upon it, the economical results that must follow research work and such work as a university with adequate means can undertake, will be of incalculable value to the industry in the not remote future." We could not wish for better testimony than this. Here we have the University at our doors —willing students desirous of increasing their knowledge, and talented professors anxious to join hands with the industry. Must we remain asleep? Or shall we awaken to the full responsibilities of our position, and, having awakened, rest not until something is accomplished?

I am going to ask you now to vote upon the matter, remembering that, by supporting this suggestion, each one pledges himself to use his best endeavours in assisting the Sub-Committee, if called upon to do so. In voting, remember the advantages we enjoy to-day through the energies of our predecessors, some of whom, I am happy to say, are with us to-night—men who worked so hard to establish the classes at technical schools. Shall we therefore earn the thanks of our successors for our labours on their behalf, or be remembered only as the neglectors of grand opportunities? By your action, I firmly believe you have the opportunity of making to-night's meeting a memorable one in our annals. See to it that the memory is a pleasant one.

Compliments to the President.

Mr. W. Buckley, who moved a vote of thanks to the President for his address, said he had known Mr. Thorp for a good many years now, and what impressed him most, in addition to that gentleman's technical skill, was the attention he always paid to detail—evidence of which they had had in the address. Mr. Thorp's lecture was a masterpiece; and the only regret one had was that their President did not tell them something more about his own meter outside what was obtained from the Technical Press.

Mr. S. E. Halliwell seconded; observing that the address would not only be of considerable value to them as members of the Association, but to a larger public outside.

Mr. T. Duxbury (Oldham), supporting the resolution, said that from personal experience he could bear out what had been said about Mr. Thorp's attention to detail; and he went on to compliment the President on his address. He said he considered the address one of the greatest value to their profession, and believed with the previous speaker that it would be read with interest by many who were outside the Association. As to the latter part of Mr. Thorp's address, he was certainly of opinion that something ought to be done on the lines suggested, so that Manchester, from a gas-engineering standpoint, might occupy a position worthy of its name and importance as a great centre.

Mr. H. Kendrick (Stretford) desired also to associate himself with what had been said about the excellence of the address. In fact, he said, it was one of the best it had been his lot to hear; and as to the proposed scheme in connection with the Manchester University, he would take the first opportunity of laying it before the Council of the Senior Association. He was satisfied that some such scheme would be of great benefit to gas engineers in the Manchester district, and to those associated with gas manufacture. It was only the other day that he said to a friend of his that Manchester could have had what the Leeds University got —the Chair of Fuel—if they had tried. Manchester was too late in the field. He did not know whether Manchester and district could raise another £10,000; but they could surely do something in the way suggested in the President's address.

The resolution was then put and carried; the President briefly responding.

University Scheme of Scholarships and Lectures.

Mr. A. L. Holton then moved the adoption of the following resolution:

That having heard from our President the proposal as to there being a bond of union between the Manchester and District Junior Gas Association and the Victoria University on distinctly educational lines, we welcome this opportunity of increasing the educational advantages of our members; and we hereby authorize the Council of the Manchester and District Junior Gas Association to go into the matter thoroughly, along with Professor Dixon and the University authorities, together with any other bodies they may deem it wise to confer with, and to send out their full suggested scheme along with the May notices to be voted on at the June meeting.

Mr. J. Alsop seconded the motion.

Mr. Nicholl (Radcliffe), in support, said, if the scheme came to fruition, it would be of great benefit to the gas industry, both to those on the inside staff and those on the outside staff, especially in view of the keen competition they had with electricity. Such, indeed, was the competition they had now to face, that it was absolutely necessary for those engaged in gas manufacture and its distribution to so equip themselves in knowledge as to be able to meet that competition. As one employed on the outdoor staff, he found that the competition was becoming keener almost every day; and he hoped the scheme mentioned by the President would be carried through.

The motion was adopted with only one dissentient.

Professor Harold B. Dixon, having expressed the hope that Mr. Thorp would see his way to deliver to the students at the University an address on gas-meters, with special reference to his own meter, proceeded to speak of the proposed bond of union between the Junior Gas Association and the University. He remarked that the greater part of what he had intended to say upon the subject had been covered by the President in his address. This he would say in addition, that there were things in which they might co-operate with benefit to the students at the University, and to those engaged in gas manufacture. He told them frankly that he had a personal interest in the proposed scheme as well as they had, and that it was not to be a one-sided arrangement. As practical men, the members of the Association had something to tell him and those attending the University; while he and the staff no doubt could in different ways help those engaged in the manufacture and distribution of gas. Problems might arise which could be satisfactorily solved by their working together; and it was his desire to have the advantage of the knowledge of practical men as well as the theoretical knowledge. In this way, he was sure much useful work could be done for their mutual benefit; and this was important, seeing that Manchester and district were so largely interested in gas and its production. When Leeds took the matter up, he rejoiced, and helped as far as lay in his power to establish the Chair of Fuel at the University there. And it was gratifying to him to know that two old Owen College students—Professor Smithells and Professor Bone—were associated with the successful carrying out of the work at the Leeds University. He saw no reason why they should not do something in Manchester on the same lines—not in opposition to Leeds, but to have a friendly rivalry between the Universities. This would result in benefit to every one; and he would say so in Leeds as openly as he said it at that meeting. If the members of the Junior Gas Association were anxious for this work to be done in Manchester, there were friends at the University ready and willing to do their best in helping forward the scheme. And he need scarcely say that he should do all he could for them. His knowledge of Manchester and Lancashire—now extending over 25 years—led him to say that, if such a proposal were taken up, it would be carried to a proper and legitimate conclusion; and this he hoped would be done in this case.

KINDRED ASSOCIATIONS.

The subsequent proceedings took the form of a smoking concert, during which a number of toasts were submitted.

Mr. R. Ginman, in giving "Kindred Associations," said that the Junior Associations owed a great deal to the help and assistance given them by the senior organizations; and in this connection he mentioned the valuable advice and support that were extended to Mr. Wellens, a Past-President, by Mr. T. Duxbury, of Oldham, when the Manchester Junior Association were in the course of formation. In recognition of these services, Mr. Duxbury had been made an honorary member of the Association.

Mr. W. Whatmough, Hon. Secretary of the Manchester District Institution of Gas Engineers, said that what had struck him particularly when attending the meetings of the Council of the Junior Association, was the business-like way in which matters on the *agenda* were dealt with. He trusted that the vigour, activity, and progress of the Junior Associations, which had been so marked since their inception, would continue. Referring to the suggested scheme in connection with the Manchester University, Mr. Whatmough mentioned that as the matter was an important one, the juniors should defer definite action till the seniors had an opportunity of considering the scheme.

The President assured Mr. Whatmough that this point would not be lost sight of.

Mr. S. W. Shepherd (Bradford) also responded to the toast. He believed that the Manchester Junior Gas Association was the first of its kind; and, this being so, must be looked upon as the mother of such organizations. From the daughter—the Yorkshire Junior Gas Association—he brought them hearty greetings. Mr. Thorp had, in his address, struck a high note, and set out a high ideal. He (Mr. Shepherd) hoped very earnestly that the ideal which the new President had put forward would be fully realized. Although Yorkshire had its Chair of Fuel at the Leeds University, they would like to see Manchester follow a good second.

The toast of "Our Guests" was given by Mr. D. V. Hollingworth, and responded to by Mr. W. J. Jenkins and Mr. Mather.

Mr. James Hill gave the toast of "The Manchester and District Junior Gas Association." He said he had watched the Association grow from very small beginnings, and never dreamt that from the classes at the Technical School such progress would be made. The work the Junior Associations were doing was very important, from an educational point of view especially; and he was in hearty agreement with the suggestions made in the President's address with regard to the University. He regretted that in his younger days there were not such facilities for obtaining practical experience as was the case to-day. Not only had the Juniors the advantages of theoretical training, but they had opportunities of gaining practical knowledge in visiting different works to see up-to-date plants. All this was of value, because to assistants had to be entrusted in a great measure the carrying out of the work planned and arranged by the senior engineers.

The President said the Junior Associations had fully justified their existence; and, in his opinion, the whole industry had benefited by their establishment.

Mr. Hill (Stalybridge), as one of the first members of the Association, responded to the toast. He promised the scheme set out by the President in regard to the University all the support he could give it—financially and otherwise.

Before the proceedings closed, the health of the new President was toasted with musical honours.

PURIFICATION OF GAS FROM SULPHUR.

An interesting paper was read at a meeting of the Manchester Section of the Society of Chemical Industry last Friday, on "Some Points in the Purification of Gas from Sulphur," by Mr. RAYMOND ROSS, F.I.C., F.C.S. The paper was written by him conjointly with Mr. JOSEPH RACE, A.I.C.

The authors had been experimenting with an apparatus used by the United Gas Improvement Company, of Philadelphia, for controlling the oxide purification of gas by means of the iodometric titration of the sulphur contents. The authors found that certain discrepancies attended the use of the apparatus; for gas entirely free from sulphuretted hydrogen gave quite an appreciable absorption of iodine. This amount, calculated to sulphur, was largely in excess of the sulphur compounds present, which, moreover, did not react with iodine. It was evident that the discrepancies were due to another constituent of the gas other than sulphuretted hydrogen.

The authors first determined to what extent iodine solution was acted upon by various substances that are known to be present in illuminating gas—like ethylene, acetylene, benzene, carbon bisulphide, thiophene, mercaptans. These were not the cause of the discrepancy; but the deduction arrived at was that the substance was a hydrocarbon that would react easily with dilute iodine solution in the cold. By preparation of the dibrome compound, it was shown that the substance causing the discrepancy was cyclopentadiene, which has previously been discovered in crude benzene from coal tar. This was confirmed by the reduction test with ammoniacal silver nitrate, when a bright mirror was obtained. The authors conclude that the iodine test is, in conjunction with the qualitative test for sulphuretted hydrogen, a very useful method of controlling coal gas purification by oxide of iron, but is useless for carburetted water gas. The presence of cyclopentadiene in the latter can be ascertained by passing the gas through toluene kept at a very low temperature.

Lime purification was next dealt with. In the opinion of the authors, lime purification was not as regular in its action as the oxide method; it being more affected by the composition of the gases and the amount of extraneous water present. Experiments were carried out daily at the lime purifiers of the Burnley Corporation Gas-Works, for a period of three months, for carbon dioxide and sulphuretted hydrogen. Before analysis, all the limes were thoroughly spent; and the amount of calcium carbonate present varied from 63 to 70 per cent.

Purification by lime, owing to the number of reacting gases present and their variations in amount, was necessarily complex. The authors had attempted to carry out a suggestion made by Mr. Butterfield in his "Chemistry of Gas Manufacture," that the reactions might be best understood by a study of each gas individually. Reference was made to the work of Divers, Shmiddzu, and Veley; and the main points of their experiments were summarized. It was found that with an excess of water at ordinary temperatures Ca(SH)(OH) was formed; but with smaller amounts of water at higher temperatures this compound was converted into $Ca(SH)_2$, and finally into CaS. The experiments pointed to the conclusion that only Ca(SH)(OH) is active in the removal of carbon bisulphide from coal gas. The $Ca(SH)_2$ and CaS may, however, be rendered active by altering the conditions so as to produce Ca(SH)(OH).

Natural Gas in Ontario.—A consular report from Ontario states that several Canadian towns are using natural gas for light and fuel. In Windsor, natural gas piped from a spot 40 miles to the north-east was recently turned into the mains and service-pipes of the local Gas Company, who had previously been supplying the city with coal gas. The gas used for illuminating purposes is purified on the premises of each customer, that consumed for heating—its general use—is employed in its natural state. The price charged per 1000 cubic feet is 1s. 0½d. in the winter and 1s. 3d. in the summer. It is stated by experts that the supply cannot be exhausted in less than twenty years.

Calcium Chloride as a Dust Layer.—It may be remembered that some time ago the Roads Improvement Association instituted a supplementary investigation into the value of calcium chloride as a dust layer; the judges appointed to conduct the tests being Mr. H. P. Maybury (Surveyor to the Kent County Council), Mr. A. Dryland (Surveyor to the Surrey County Council), Mr. G. W. Manning (Surveyor to the Staines Rural District Council), and Mr. W. J. Atkinson Butterfield, F.I.C., F.C.S. (Consulting and Analytical Chemist). Their report has been issued; and the following are the conclusions arrived at: "Having now had an opportunity of inspecting various sections of roads which have been regularly treated with calcium chloride during the past summer, and also of considering the reports of various surveyors in different parts of the country, referred to previously, who have used calcium chloride, we are of opinion that the treatment has the ill-effects of causing during the winter months an abnormal quantity of sticky mud, a decided tendency to licking-up, and a disintegrating action upon the macadam surface. Notwithstanding this, we are of opinion that the process is probably not more injurious to macadamized roads than the excessive watering now demanded by the public effectively to lay the dust.

SCOTTISH JUNIOR GAS ASSOCIATION.

WESTERN DISTRICT.

The Annual Meeting of the Western District Division of the Scottish Junior Gas Association (the concluding meeting for the session) was held in the Technical College, Glasgow, on Saturday—Mr. D. CURRIE, of Stirling, the President, in the chair. There was a good attendance.

AWARDS FOR THE BEST PAPERS.

At the meeting of the Association in November last, it was announced that Mr. A. Smith, the Manager of the Tradeston Gas-Works of the Glasgow Corporation, had offered a medal to the author of the best paper read during the session; and that Mr. Walter Grafton, the Assistant-Engineer and Manager in Glasgow, had offered a book as a second prize.

The PRESIDENT, referring to this matter, intimated that the Adjudicatory Committee had just met to consider their decision, with the result that Mr. F. L. M'Laren, of Dumbarton, had been unanimously awarded the medal for his paper on "Producers and Internal Combustion Engines;" and that to Mr. J. M. Smith, of Dumfries, they had given second prize, for his paper on "The Manufacture of Sulphate of Ammonia."*

THE WILLIAM YOUNG MEMORIAL FUND.

The SECRETARY AND TREASURER (Mr. D. Fulton, Dawsholm) read a circular which had recently been received from the Secretary of the William Young Memorial Committee, explaining their proposals.

The PRESIDENT said the Council had had the communication under consideration, and unanimously recommended the Association to contribute one guinea to the fund.

More than one member expressed the opinion that the sum proposed was too small; but it was explained that it amounted to 10 per cent. of their funds. It was unanimously agreed to vote the sum named as "a first instalment;" the intention being that if more money were required, and the Association could afford it, a further contribution might be made.

THE ANNUAL ACCOUNTS.

Mr. FULTON also read a provisional balance-sheet, which showed that the income of the Association for the year, including £18 brought forward, amounted to £51, and that there remained a balance of £21.

ELECTION OF OFFICE-BEARERS.

The following were elected office-bearers for next session:

President.—Mr. J. Fraser, of Provan.
Vice-President.—Mr. A. Kellock, of Alloa.
Hon. Secretary and Treasurer.—Mr. D. Fulton, of Dawsholm.
Members of Council.—Messrs. T. Orr, of Motherwell; F. Cuthbert, of Kirkintilloch; T. W. Saville, of Thornliebank; J. Smith, of Glasgow; and J. Grant, of Glasgow.
Auditors.—Messrs. J. Mann and J. Smith, of Glasgow.

GAS COMBUSTION.

Mr. WALTER GRAFTON then delivered a lecture on this subject, in the course of which he said:

In bringing the subject of gas combustion before you this evening, I will endeavour to be as concise as possible, and will avoid most of the history of the subject, and also much detail of the various plans which have been tried, as, although the birth of a new idea may occupy little time, the experimenting has taken long and patient application, yet it often takes still longer to convince others that a particular method or thing is worthy of adoption. Nevertheless, I must claim your indulgence for having to deal with this important matter in a very brief manner. The whole subject would take a great deal longer to describe in detail than the time at my disposal. I also claim your indulgence for omitting many details, but will try to make up for this by demonstrating my points.

When we burn or consume illuminating gas, what object have we in view? To all who value the real progress of the gas industry, the answer would be, first, that gas must be not only completely, but economically, burnt, whatever the conditions or the kind of burner used—whether atmospheric or lighting burners; second, that the best possible light or heat must be obtained from the volume of gas consumed. Now the light from the combustion of gas is not merely obtained as a result of combustion pure and simple. It must be developed. Heat, on the other hand, is independent of development. By the action of complete combustion the amount of heat evolved is absolutely the same in every case, no matter how burned; and this admits of no exception. Of course, the amount of heat varies with different samples of gas; so that all we can do is to aim at utilizing in some useful way as much as possible of the heat evolved. It is of the utmost importance, when economy is of the slightest consideration, that the burner shall be designed to obtain in regular use the best possible result for each special purpose. Let me quote a passage from the "JOURNAL OF GAS LIGHTING" for Nov. 2, 1909, p. 300, on the test-burner, to emphasize this point: "Everything possible that is effective in assisting the industry, even in respect of the proper

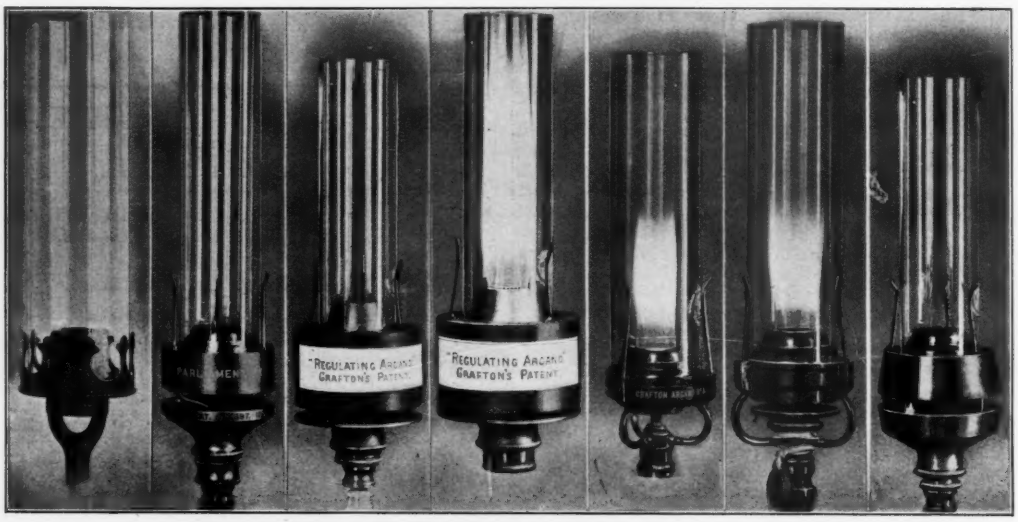
* Mr. M'Laren's paper was noticed in the "JOURNAL" for Dec. 7 last (p. 679), and Mr. Smith's in the issue for the 8th ult. (p. 665).

valuation of the gas supplied, must be done for the sake of progress in the right direction." By law, the burner to develop the lighting value of gas is an argand. Now this type of burner dates back over one hundred years; for I find it mentioned by our respected pioneer, Murdoch, in a paper he read before the Royal Society in 1808. Quoting from the paper he wrote: "The gas-burners are of two kinds—the one is upon the principle of the argand lamp, and resembles it in appearance, the other is a small curved tube with a conical end, having three circular apertures or perforations." Then, in the third edition of Accum's "Treatise on Gas-Lights (1816)" we read: "The burners are formed in various ways. Two concentric tubes of brass or sheet iron are placed at a distance of a small fraction of an inch from each other, and closed at the bottom. The gas which enters between these cylinders, when lighted, forms an argand lamp, which is supplied by an internal and external current of air in the usual manner." Now in Murdoch's paper already referred to, we find it stated that each of the argands in use gave "a light equal to that of 4 candles (mould candles of six to the pound);" and each of the cockspurs (referring to this type of burner) "a light equal to 2½ of the same candles." From these results one can only conclude that, besides being burnt in an ignorant and wasteful manner, the gas consumed was very deficient in illuminating value in those days.

Very little is known of the actual quality of gas supplied to the public prior to 1860. In that year, a standard of lighting value and provision for testing were first enacted in the Metropolis Gas Act. The standard of 12 candles was fixed for common gas, to be consumed at 5 feet per hour in an argand burner having 15 holes and a 7-inch chimney. There were several of this type of burner. I have here a Sugg-Letheby model for 14-candle gas, as will be seen from the mark "14 C" on the side of the burner (fig. 1). Before the Gas Referees prescribed a burner for testing, it was very much a case of trial and rejection—trying first one burner then another, till the proper one was found. Dr. Letheby's rule was as follows: "The standard burner is arranged so that the supply of air to the interior and exterior of the column of flame shall be sufficient properly to consume the standard quantity of gas. Under no circumstances should the gas be tested for illuminating power unless it is properly consumed without over-oxidizing the flame." Let us see how this old 14-candle burner, having 15 holes and "perforated regulator for air," develops 15½-candle coal gas consumed at 5 cubic feet an hour, in other chimneys besides the 7-inch.

Length of Chimney.	Illuminating Power of Flame.		
	Air Open (Chimney Regulation only).	Length of Flame.	Character of Flame.
Inches.		Inches.	
4½	10·80	3½	Good.
5	10 37	2½	,,
6	10 37	2½	,,
7	10·20	2⅜	Short.

The 4½-inch chimney was the shortest that would allow 5 feet to burn in it, and developed the highest result; being only 0·6 candle better than the stipulated 7-inch chimney. With this old burner, the bulk of the air passes directly up the chimney without ever developing the gas-flame. This cannot happen with the modern burners, because the air is caused to flow directly to the flame; hence, if not regulated, the flame is so rapidly consumed



1 2 3 4 5 6 7

Types of Testing Burners.

No. 1.—"Sugg-Letheby," fifteen-hole argand and 7-inch by 1⅛-inch chimney, with perforated regulator for air. No. 2.—"Parliamentary" fifteen-hole argand and 7-inch by 1⅛-inch chimney, with regulator having perfect control of all air. No. 3.—No. 1 "London" argand with 6-inch by 1⅛-inch chimney, with air regulator attached. No. 4.—Same burner, but showing the flame adjusted to the verge of smoking. No. 5.—"Ideal" or Grafton twenty-four hole argand with 6-inch chimney and flame. No. 6.—No. 2 "Metropolitan" with 6-inch chimney, showing the third air supply shut and resulting flame. No. 7.—The "Universal" twenty-four hole argand with 6-inch by 1⅛-inch chimney, and regulator controlling all air supply.

that it only develops heat instead of light, which is of no advantage whatever to the consumer, and simply brings discredit to the manufacturer. Yet I might say this burner was used all over the world. It was clearly too early in the history of gas lighting to prescribe maximum value; and we do not find any such provision until the London Gas Act of 1868. This Act required the Gas Referees to prescribe the burner to be used, and that "it shall be such as shall be the most suitable for obtaining from the gas the greatest amount of light, and be practicable for use by the consumer." In pursuance of this requirement, the Gas Referees prescribed, on March 31, 1869 (just 41 years ago), Sugg's "London" argand (that size having 24 holes, then called "No. 1" but now known as "No. D") as the standard test-burner for London. Its dimensions were altered about Dec. 10, 1870, particularly the centre aperture (0·47-inch diameter), and again, on July 25, 1876, Dr. Pole sent Mr. Sugg the settled dimensions of the standard argand test-burner, providing for chimneys for 16-candle and 14-candle gas.

The No. 1 argand has been used in very many ways, with but one object—to better develop the light from the gas burnt in it. From an old note book given me by the late Mr. William Sugg, I glean: "That an argand burner for the economical burning of gas requires its regulating apparatus for the admission of air as much as an argand burner for burning oil." As near as I can tell, this was written by him in 1867, yet, strange to say, was never acted up to other than the fixed dimensions laid down by the Gas Referees. The No. 1 "London" argand burner is subject to variation in the quantity of air drawn in by the volume of flame in the chimney, let alone the effect of temperature, volume, and kind of gas consumed in it. This I have now altered, with what success will be best judged by the results given in the lower part of Tables I. and II. I regret, however, the burner cannot be made more perfect without structural alterations, leaving out of consideration my earlier structural modification (figs. 2 and 3). The results, nevertheless, are very interesting, as showing what can be done by proper control of the air supply, and are, in many cases, better than those by the No. 2 "Metropolitan" argand. The flame can be actually raised above the top of chimney before smoking, as fig. 3 clearly shows. If nothing else, the figures go to prove that any advance in the quality of the gas is not the result of the change of burner, but simply and solely a matter of air regulation bringing out of the gas that which is in it "without over-oxidizing the flame," as Dr. Letheby specified for but never realized. With carburetted water gas the old 16-candle flame basis of using the burner with full air is superior to the Metropolitan regulation method.

The opposition to anything good if new is passingly strange. The opposition to-day to the general adoption of a change of burner is not, however, new. In 1869, Mr. T. W. Keates, F.C.S., considered the No. 1 "London" argand burner raised the lighting power of common gas by 16 per cent., to the detriment of the common fish-tail burner for the public. But I contend the

consumer was, and is, no worse off by the better apprizement of the gas. In those days the flat-flame burners were not so good as at the present time, and 6, 7, and 8 candles per 5 cubic feet was the order of the day, or 51 per cent. as compared with the argand results. Advance has been made with the flat-flame burners (independent altogether of the magnificently economical incandescent mantle lighting) as well as with the testing burner; for the public get, on an average, to-day, over 66 per cent. of the actual value from modern flat-flame burners. In other words, 9 to 10 candles, or 1·8 to 2 candles per foot of gas, as rock-bottom value, is obtained, which is considerably more than the figures given in Table A (p. 45). I have a fine specimen of the old regulator burner, bearing the Crown coat of arms, and which dates back to 1858. The regulator consists of a plug of fine iron wire; and the results per 5 cubic feet are poor alongside the Referees' Bray flat-flame burner used to-day. Some interesting figures are given in Table B, which clearly show what can be obtained by the better blending of the burners in this day of pressure requirements.

Finality in the construction of argand burners has not been reached by the No. 2 "Metropolitan" argand, which is my "Ideal" burner (fig. 4) modified by removing the patented centre peg-head and adding the Carpenter air-regulator. Having tried all kinds, varieties, and qualities of illuminating gas in the No. 2 "Metropolitan" burner, in England, Scotland, and Ireland—and which fairly represents the gas supplied in Britain—I find that it does not bring the results within the requirements laid down by Parliament in 1868-69 and cited above. Further, Parliament, in the London Gas Act, 1905, again enacted that the Gas Referees shall prescribe the burner for testing the illuminating value of the gas supplied by the London Gas Companies, subject to this condition—that "the burner so prescribed shall be of such a pattern (not being an incandescent or similar burner) as shall be practicable for use by the consumer; and the burner and the chimney (if any) shall be the most suitable for obtaining, and in making the test shall be so used as to obtain, from the gas, when consumed at the rate of 5 cubic feet an hour, the greatest amount of light." From this the Gas Referees are under the obligation to prescribe the most suitable burner that will comply with this requirement. Also, the Model Testing Clauses provide for the use of the "most suitable burner" and the "greatest amount of light" being got from the gas.

In bygone days, the actual choice of the burner was left to the users, so long as it complied with the restrictions laid down. These, as well as the other more important requirements of modern gas supply, have to be taken and provided for when constructing an efficient argand burner that will develop the "greatest amount of light" from the gas consumed at the stipulated rate of 5 cubic feet an hour. It is no wonder that the making of such a burner has taken up so much time and ingenious skill; and the remarkable degree of efficiency to which it has been brought is testimony to the thought and perfect knowledge possessed of the principles of combustion which have been bestowed upon it. The true principles of construction are only evinced in modern argands that are capable of consuming any kind of illuminating gas to the best possible advantage, alike for the gas authority as for the consumer. The modern "Parliamentary" argand having 15 holes and a 7 in. by 1⅝ in. chimney is one of them (fig. 5); but I prefer a 24-hole argand, such as the No. 1 "London" or the "Ideal." The latest development in argands has 24 holes, and a 6 in. by 1⅝ in. chimney. It is a further development of the air-regulating type, but with total control of the air supply. One form is illustrated by fig. 6. It is on the principle of no air no gas combustion. It has been called the "Universal" No. 3 because it develops the light of the three kinds of gas supplied to the public to-day. Comparative results obtained with the "Universal" and No. 2 "Metropolitan" burners, by using both in the same way, are given in Tables I., II., and III. The results clearly show that the "Universal" burner is the most suitable to the changed conditions of modern gas supply and use. Tables IV. and V. illustrate some remarkable results. Besides the earlier regulation method of setting the flame to just smoking, then opening the damper half-a-turn, the third supply of air or quantity not under control in the No. 2 "Metropolitan" burner is closed, causing the flame to smoke badly, or, if not smoking (fig. 7), the flame can be regulated in the usual manner—in either case yielding a higher value for the gas than the present regulation method. Other methods are given, clearly proving that the No. 2 "Metropolitan" burner does not develop the "greatest amount of light," but often defeats its object by yielding a lower value. Side by side are given the results by the new argand, which are much in advance of anything yet obtained by the No. 2 "Metropolitan" argand. The range of the "Universal" is greater, and the results certain and uniform; and, in the words of the Act, the "greatest amount of light" obtainable from the combustion of 5 cubic feet an hour is secured. We want success and not failure. The "Universal" burner is full of atmosphere of the right kind, void of all personal element in yielding the value of the gas if properly regulated.

Lighting value is the only true criterion by which the value of illuminating gas may be judged for all domestic and public lighting. Blue gas in a lamp, inside or outside, is no security to life or property without a mantle; and it is for this great purpose that we require a lighting test—certainly not a flat-flame test, because, knowing the candle value of a gas by the argand, we also know the relative value by a good flat flame. This latter is at once secured by means of a Bray's No. 7 economizer being placed over any "rough" old fish-tail "friend," increasing the light as shown in Table B, which is self-explanatory. These tests are more severe on the burners than those given in Table A. A calorific standard is out of the question, for it has taken us a hundred years to learn how to arrive at the true illuminating value. Many may think he industry's troubles would cease by having a heating test. It do not think so. They may; but when are you going to start—that is, in fairness to the gas industry. I suggest that 31 B.Th.U. net per candle is a fair and desirable heating value for 14-candle gas as a fixed unit of heat, with a margin of 5 per cent. before any penalty be imposed, because one must not forget that the lighting value test will guard the calorific value. Mr. E. H. Stevenson was much of this opinion when he, some time ago in the House of Commons, said: "The calorific value of the gas is very well known if you know what the illuminating power of it is."

To-day, economies are pressingly necessary in the interests of the consumers, especially seeing that the industry has to fight a

TABLE I.—*Illuminating Value of Coal Gas.*

No. 2 "Metropolitan" Argand 6 in. by 1⅝ in. Chy. and 5 Cub. Ft. per Hour.	"Universal" Argand No. 3 6 in. by 1⅝ in. Chy. and 5 Cub Ft. per Hour.	Increase in Value.	
Regulation Method. Carpenter Regulator. Flame Set to Verge of Smoking.	Grafton Regulator. Flame Set to Verge of Smoking.	Candles.	Percentage.
Candles.	Candles.		
13·08	14·17	1·09	8·33
13·71	14·71	1·00	7·30
13 87	14·75	0·88	6·34
14·16	15·07	0·91	6·33
14·18	14·97	0·79	5·57
14·19	14·96	0·77	5·43
14·68	15·28	0·60	4·09
14·76	15·70	0·94	6·09
15·10	16·37	1·27	8·41
15·74	17·04	1·30	8·26
18·79	19·62	0·83	4·42
19·18	20·15	0·97	5·05

No. 2 "Metropolitan" Argand 6-in. Chy. and 5 Cub. Ft.	No. 1 "London" Regulating 6 in. by 1⅝ in. Chy.			
	5 Cub. Ft. per Hour.		16-Candle Flame.	
Regulation Method. Carpenter Regulator. Flame to Verge of Smoking.	Full Air Supply.	Grafton Regulator. Flame to Verge of Smoking.	At Full Air. Candles per 5 Cub. Ft.	Then Regulated to Verge of Smoking. Candles per 5 Cub. Ft.
Candles.	Candles.	Candles.		
— 13·84	11.93	13·54	13·48	13·85 (*a*)
— 14·19	12·75	14·00	13·84	14·27 (*a*)
— 14·66	12·80	14·42	14·32	14·87 (*a*)
Open				
14·23 15·70	15·27	17·00	15·88	17·18 (*b*)

(*a*) Coal Gas. (*b*) Carburetted Water Gas.

TABLE II.—*Illuminating Value of Mixed Coal and Carburetted Water Gas.*

No. 2 "Metropolitan" Argand 6 in. by 1⅝ in. Chy. and 5 Cub. Ft. per Hour.	"Universal" Argand 6 in. by 1⅝ in. Chy. and 5 Cub. Ft. per Hour.	Increase.		Calorific Value.	
Regulation Mehod. Carpenter Regulator. Flame to verge of Smoking.	Grafton Regulator. Flame set to verge of Smoking.	Candles.	Percentage.	B.Th.U. Gross.	B.Th.U. Net.
Candles.	Candles.				
13·90	15·32	1·42	10·22		
13·92	15·37	1·45	10·42	553	498
14 01	15·48	1·47	10·50		
14·10	15·41	1·31	9·30	551	515
14·24	15·50	1·26	8·85		
14·56	15·79	1·23	8·45		
14·76	15·98	1·22	8·46	537	492
15·22	16·49	1·27	8·34		
15·25	16·92	1·67	10·95	540	504
16·44	17·82	1·38	8·39	"	
17·01	17·97	0·96	5·64		
18·30	19 31	1·01	5·52		

No. 2 "Metropolitan" Argand 6 in. Chy. and 5 Cub. Ft.		No. 1 "London" Argand Regulating 6 in. by 1⅝ in. Chy.				"Wandsworth" Argand 7 in. by 1⅝ in. Chy and 5 Cub. Ft.
		5 Cub. Ft. per Hour.		16-Candle Flame.		
Full Air Supply.	Regulation Method. Carpenter Regulator. To Verge of Smoking.	Full Air Supply.	Grafton Regulator. To Verge of Smoking.	At Full Air Supply. Candles per 5 Cub. Ft.	Then Regulated to Verge of Smoking. Candles per 5 Cub. Ft.	Chimney not Full of Flame.
Candles.	Candles.	Candles.	Candles.			
11·22	13·90	11·00	13·88	13·67	14·18	..
10·54	13·92	10·42	13·93	12·95	14·00	..
12·08	14·56	11·91	14·90	13·28	14·52	..
10·35	14·76	10·52	14·02	13·20	14·77	..
11·24	14·24	12·32	14·33	14·14	14·86	13·66

TABLE III.—*Illuminating Value of Carburetted Water Gas.*

By No. 2 "Metropolitan" Argand 6 in. by 1⅛ in. Chy. and 5 Cubic Feet Per Hour.			By "Universal" No. 3 Argand, 6 in. by 1⅛ in. Chy. and 5 Ft.	Increases.				Calorific Value.	
Full Air Supply.	Regulation Method. Carpenter Regulator. Flame Set to Verge of Smoking.	Regulator Half Turn More Open.	Flame Regulated to Verge of Smoking.	Half Turn Above Regulation Method.		"Universal" Above No. 2 "Metropolitan."		B.Th.U.	
Candles.	Candles.	Candles.	Candles.	Candles.	Per Cent.	Candles.	Per Cent.	Gross.	Net.
6·90	11·38	12·33	14·14	0·95	8·25	2·75	24·05		
7·92	13·78	..	16·66	..	..	2·88	20·90		
10·60	15·59	15·71	17·56	0·12	0·77	1·97	12·64		
10·62	15·06	..	16·81	..	..	1·75	11·62	473	440
11·24	13·97	14·45	17·05	0·48	3·50	3·08	22·04	477	445
12·37	15·63	..	18·00	..	..	2·37	15·16	..	..
14·50	16·03	16·92	18·11	0·89	5·55	2·08	12·97	489	454
15·11	16·40	17·30	19·04	0·90	5·50	2·64	16·10	..	..
15·75	16·56	17·65	19·13	1·09	6·58	2·57	15·52	..	..
16·25	17·38	..	20·03	..	..	2·65	15·24	..	..
16·73	17·46	..	19·85	..	..	2·39	13·69		
17·00	17·39	18·47	19·53	1·08	6·21	2·14	12·30		
17·48	17·39	19·05	19·69	1·66	9·54	2·30	13·22		
17·55	17·35	..	20·33	..	..	2·98	17·17		
18·35	18·16	..	21·15	..	..	2·99	16·46		
18·37	18·24	19·16	20·19	0·92	5·04	1·85	10·14		
18·40	18·22	..	20·67	..	..	2·45	13·44		
18·60	18·10	19·24	19·88	1·14	6·30	1·78	9·83		
18·65	17·95	19·02	20·09	1·07	6·00	2·14	11·92		
18·75	18·15	19·21	20·20	1·06	5·84	2·05	11·29		
19·73	18·73	..	20·16	..	..	1·43	7·64		
20·48	19·77	..	21·42	..	..	1·65	8·34		
21·04	20·01	..	21·86	..	..	1·85	9·24		
Average of six 21·59*	Less gas than 20·98	5 ft. = 4·6 ft. 22·64	24·82	1·66	7·91	3·84	18·30		

* 2·97 per cent. increase above Regulation Method.

TABLE IV.—*Illuminating Value of Carburetted Water Gas.*

By No. 2 "Metropolitan" Argand 6 in. × 1⅛ in. and 5 Cubic Feet per Hour, with 7-inch Chimney.													The "Universal" No. 3 Argand 6 in. × 1⅛ in. Chimney and 5 Cubic Feet per Hour.	
Full Air Supply.	Flame Length.	Regulation Method. Carpenter Regulator Set to Verge of Smoking.	Length of Flame.	Regulator ¾-1 Turn More Open.	Length of Flame.	Third Supply of Air Shut. Centre and Middle Supplies Open.	Length of Flame.	Carpenter Regulator Set to Verge of Smoking.	Length of Flame.	Third Supply of Air Shut. Centre and Middle Supplies Open.	Length of Flame.	Carpenter Regulator Set to Verge of Smoking.	Length of Flame.	Grafton Regulator Set to Verge of Smoking.	Length of Flame.
Candles.	Inches.	Candles.	Inches.	Candles.	Inches.	Candles.	Inches.	Candles.	Inches.	Candles.	Inches.	Candles.	Inches.	Candles.	Inches.
7·00	1½	11·40	5	12·34	1⅝	6·92	1½	10·97	2½	..	..	..	..	14·15	2½
12·37	..	15·63	..	..	..	15·63	..	16·75	..	..	..	..	..	18·29	..
14·23	2	15·70	..	17·32	..	16·35	2	18·13	3	..	..	..	..	19·13	..
15·33	..	16·52	4⅛	17·45	2⅛	..	..	..	..	14·99	2½	17·20	3½	19·16	4
17·00	2	17·39	..	18·47	2⅝	17·60 Smoking		..	..	18·26	2½	18·80	2⅝	19·53	3½
18·48	2½	18·07	..	19·13	2½	19·63 Smoking		..	..	19·49	2½	20·64	3½	..	..
18·64	2½	17·95	4½	19·02	2½	..	..	..	..	..	..	19·94	3	20·09	3⅜
18·60	2⅜	18·10	4½	19·24	2⅝	..	..	..	..	..	..	19·96	3½	20·25	3⅝
18·75	2½	18·15	4	19·21	2⅜	..	..	..	..	..	..	20·27	2⅝	20·29	4
19·48	..	18·18	..	..	..	Smoking badly, so reduced gas to verge of smoking 21·70, rate 4·4 cubic feet. All open full air 20·65, rate 4·4 cubic feet. Air regulated to verge of smoking 18·70, rate 4·4 cubic feet.				..	..	..	..	.	..
20·98	2⅝	Brown flame 19·73	4⅜	..	..	..	..	..	..	22·53	Smoking badly	..	..	..	..

TABLE V.—*Illuminating Value of Carburetted Water Gas.*

By No. 2 "Metropolitan" Argand.									The "Universal" Argand 6-inch Chimney.	"Wandsworth" Argand 7 in. by 1⅛ in. Chimney.	Parliamentary Argand 7 in. by 1⅛ in. Chimney.
Full Air Supply.	Cubic Feet per Hour.	Length of Chimney.	Regulation Method. Carpenter Regulator Set to Verge of Smoking.	Third Supply of Air Shut. Flame Smoking Badly.	Reduced Gas Consumption. Full Air Supply.	Cubic Feet per Hour.	Carpenter Regulator. Set to Verge of Smoking.	Third Supply of Air Shut. Verge of Smoking.	"Grafton" Regulator Set to Verge of Smoking. Candles per 5 Cubic Feet.	No Regulator, would not Burn 5 Cubic Feet; Gas reduced to 4·4 Cubic Feet. Chimney Full. Candles per 5 Cubic Feet.	Gas Reduced to Verge of Smoking. Candles per 5 Cubic Feet.
					Results calculated to 5 Cubic Feet.						
Candles.		Inches.	Candles.	Candles.	Candles.		Candles.	Candles.			
21·40	5·00	6	20·76	21·40	22·32	4·40	20 51	24·26	24·35	20·10	..
21·22	5·00	,,	Verge of smoking	..							
22·05	4·50	,,	..	22·80	21·97	4·30	20·98	23·71 flame 3¼ in.	23·90	..	..
21·16	5·00	6	20·77	20·70	23·07	4·30	20·23	24·31 3¼ in.			
21·49	5·00	7	20·06	..	Third air supply shut gas to just smoking			Full air supply	..	..	.
					23·54	4·55	19·03	22·62			
22·16 less gas	5·00	6	21·87	..	..	..	..	..	..	..	25·67
24·00	4·40	,,	19·33								

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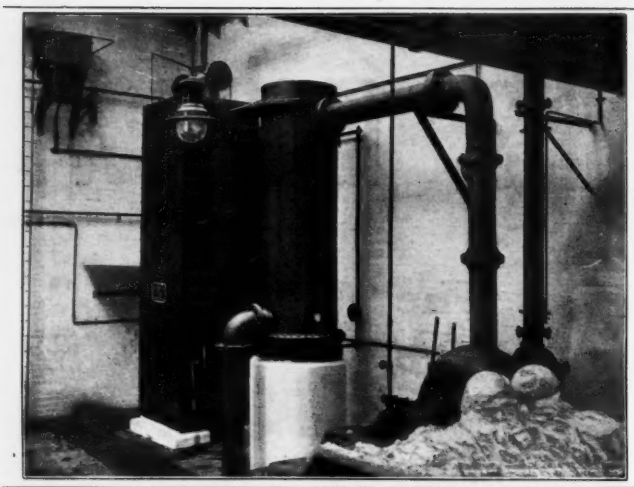

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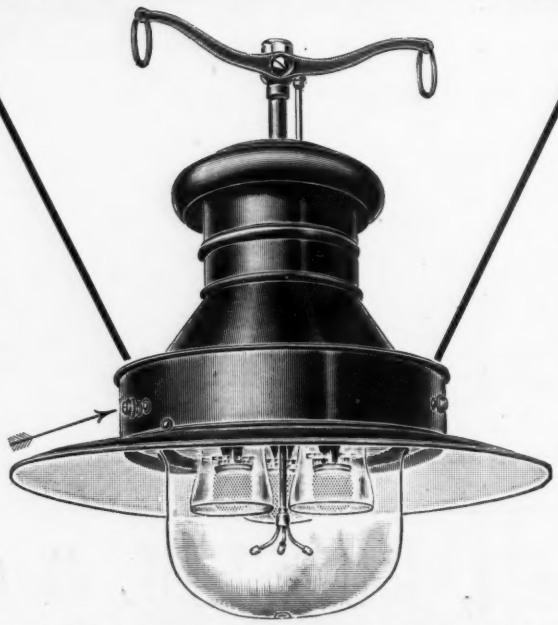

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TABLE A.—*Flat-Flame Results of Gas in* 1860-1868.

[Illuminating power by 15-hole Argand burner, 7-inch chimney, consuming 5 cubic feet per hour, gave a light of 14-candles.]

Burner. Batswing.	Pressure in Tenths of an Inch.	Quantity of Gas Consumed.	Illuminating Power.	Value of 1 Cubic Foot of Gas.
		Cubic Feet.	Candles.	Candles.
No. 3	20	5·0	6·00	1·20
,, ...	15	,,	6·50	1·30
,, ...	10	,,	8·00	1·60
No. 4	5	,,	8·90	1·78
No. 6	25	12·5	9·75	0·78
,, ...	10	11·0	7·05	1·41
,, ...	5	5·0	9·00	1·83
The slits in the burners were slightly enlarged, with the following results: —				
No. 3	10	5·0	9·00	1·80
,, 4	10	,,	9·50	1·90
With Newcastle Gas.				
Large 15-hole argand	3½	7·0	22·0	3·14
	½	5·0	14·0	2·80
Batswing No. 7 . .	4½	5·0	9·0	1·80
,, ,, 5 . .	4½	5·0	8·6	1·72
Fishtail ,, 6 . .	6½	5·0	9·3	1·86
,, ,, 5 . .	9	5·0	6·3	1·26

From this table, to quote the late Mr. Sugg in 1867-8, "the standard argand burner will, when consuming common gas, be found to produce a light from each cubic foot of gas 50 per cent. superior to the large batswing."

Then again in 1883, Mr. T. Fairley, F.R.S.E., of Leeds, carried out many tests of gas by flat-flame burners. I need only give a few to show that in those days the gas was either not so good as credited by the argand or the burners were poor developers of light, which amounts to the same thing.

Burner.	Pressure in Tenths of an Inch.	Consumption per Hour.	Illuminating Power per 5 Cubic Feet.	—
		Cub. Ft.		
Fishtail—				Quality of gas 19 candles by the standard No. 1 "London" argand.
No. 3 regulator .	10	4·80	7·20	
,, ,,	15	6·20	6·05	
No. 4 ,,	15	8·20	8·80	
Batswing—				
No. 3 regulator .	10	5·64	14·80	
,, ,,	15	7·83	13·40	

The above tests are of the flat side of the flame.

In Table B are given the results of gas tested at the rate of 5 cubic feet per hour, with special reference to the pressure required in order to ensure this, and the illuminating value of gas under examination.

TABLE B.—*Gas Tested at* 5 *Cubic Feet per Hour.*

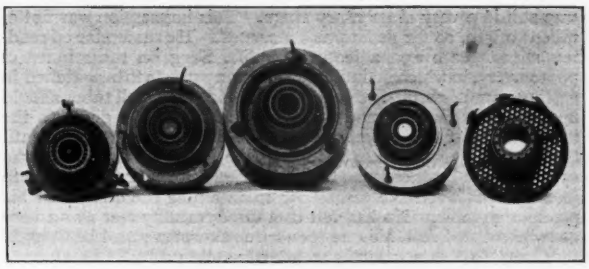
[Flames at an angle of 45° to the disc.]

No. 4 regulator flat-flame. *Candles.* 8·81 at 6-10ths.	5 on 4. *Candles.* 14·01 at 9¼-10ths Increase 59·0 in light p.ct.	7 on 4. *Candles.* 15·30 at 7-10ths 73·6 p.ct.	W. & D. on 4. *Candles.* 13·7 at 6½-10ths 55·5 p.ct.
No. 3 regulator. 5·56 at 10-10ths.	5 on 3. 13·02 at 13-10ths Increase 134·2 p.ct.	7 on 3. 15·46 at 11-10ths 180·5 p.ct.	W. & D. on 3. 13·65 at 9⅞-10ths 145·5 p.ct.
No. 2 regulator. 3·47 at 14-10ths.	5 on 2. 12·53 at 15-10ths Increase 261·4 p.ct.	7 on 2. 15·57 at 13-10ths 348·7 p.ct.	W. & D. on 2. 13·40 at 12½-10ths 286·1 p.ct.

NOTES.

W. & D. = Williams and Dean's thimble.
5 on 4 = Bray's No. 5 economizer on No. 4 fishtail.
7 on 3 = ,, No. 7 ,, ,, No. 3 ,,

competitor absolutely unfettered in its actions. Again, some men claim that a reduction of the standard price chargeable for the gas should be imposed by way of compensation for any advantage that would follow the adoption of a change of burner. I do not support, whole heartedly, such a course, because, supposing a gas company were supplying 14-candle gas, and ultimately obtained sanction to use a better burner but still supply 14-candle gas, the value of the gas is the same from a lighting point of view. The candle power is not cut down. The candle referred to is a standard candle; and although one or more is obtained for the gas by the change of burner, the consumer gets practically all the benefit of the change, which undoubtedly allows us to take advantage of any improved method of manufacture. Anything that enables us to sell gas more cheaply is in the public interest, and, again I say, it is what the whole industry is striving for to-day—full justice to be done to the gas. Fig. 8 shows the structure of the



B

Types of Testing Burners.

No. 8.—Showing the general structure of the holes and air-ways of the Sugg-Letheby; Parliamentary; No. 1 "London;" Ideal; and No. 2 "Metropolitan" argands.

holes and the outlet air-ways of the Sugg-Letheby parliamentary No. 1 "London" argand with complete control of the air supply, and the "Ideal" and No. 2 "Metropolitan" argands.

As the time is getting on, I must leave the practical and utilitarian side of the heating value of gas until another time; but I want to show you another new step—a red-hot gas-flame. We have all seen a blue atmospheric gas-flame of one degree or other of the Bunsen character in the cooker, the gas-fire, and incandescent burner, each playing its part more or less economically. The most urgent improvement is needed either in the way we burn our gas in our gas-fires, or the gas-fires themselves must be remodelled. I predict that the truly ideal gas-fire is not invented; but it will come. Here we have a red-hot and an ordinary good Bunsen blue flame. Hard glass is not affected by the blue flame; but in the red-hot one it readily melts to dropping point. This is a valuable flame, and it is one that I am trying to utilize more effectively.

In conclusion, I have to thank all those who have in one way or other rendered me assistance, whether in Scotland or England, and for your attention this evening. I am glad of one thing—that two steps in advance have been made in Glasgow for the gas industry, and particularly so when it is considered that it was in Glasgow in the year 1820 that the union-jet burner had its origin, in the joint invention of Mr. James B. Neilson, the Manager of the Glasgow Gas-Works, and Mr. James Milne, the founder of the firm of Milne and Son, of Glasgow. Therefore your city is already famed in gas history.

Discussion.

The PRESIDENT intimated that Mr. Grafton had kindly consented to throw open his lecture to discussion, and said he would be very pleased to answer any questions.

Mr. A. H. WHITELAW (Glasgow) thought the question of the red-hot flame had interested everyone in the meeting. The lecturer said it was not so fully aërated as was the bunsen flame; and yet it had a higher temperature. He (Mr. Whitelaw) would require to see this tested by a pyrometer before he could thoroughly comprehend it. He was always under the impression that the hottest flame they could get was the bunsen flame. They had seen experiments in which primary air driven in raised the temperature, and the flame became smaller up to a certain point, beyond which the temperature fell again, and finally they had the flame going out. There they had a flame which was not fully aërated, and yet they were told that it had a higher temperature than the bunsen flame. He had his doubts on the matter. As regarded this flame being useful in gas-fires, he sincerely hoped it might be; but it seemed to him to be a flame which was easily acted upon by draughts, whereas they wanted one that would stand a good deal of knocking about with wind. A flame in a gas-fire would have to be one that could do this if it was to be the success that was desired.

Mr. J. M'LEOD (Greenock) said he was much interested in the point of the flame which Mr. Grafton had shown them, and he would like to have a little more explanation with regard to it. He considered it extremely interesting to see that the new test-burner—the "Metropolitan" argand No. 2, of which they all thought so highly—was only a transition burner after all, and that they were still looking out for something better. He thought Mr. Grafton had demonstrated that he could achieve better results than could be obtained by the use of the new burner. He (Mr. M'Leod) had no doubt himself that the tests were absolutely right. In his own experience, he found that with the old argand he could get better results than with the Silber No. 1 "London" argand, which was the test-burner in use up to the time the "Metropolitan" burner was brought into use. This showed that even the standard test-burner was not the best for developing the illuminating power of the gas. In the same way, he thought, the "Metropolitan" must give way to Mr. Grafton's "Universal" burner.

Mr. J. NAPIER MYERS (Saltcoats) remarked that he was not at all an expert in photometry; but he was certainly impressed with the great care displayed by Mr. Grafton in connection with the information he had laid before them, and he was sure they were all extremely indebted to him. They could see, as the outcome of very careful experimenting, how varied the results were. It was apt to make the impression that the business of testing light

was still in a very elementary stage. This impression was not of recent origin, so far as he was concerned. He remembered reading, many years ago, a lecture by Mr. Sugg on the science of photometry, in which he indicated the many points to be watched in getting careful results. He recommended that small tubes should be frequently cleaned, and that attention should be given to the temperature of the room, in regard to heat and moisture, until the impression was made upon him (the speaker) then, as it was now, that the business was far too intricate for a practical man to look upon as a reliable means for maintaining the quality of his product equable. He had felt that the durability test was a very convenient and suitable one for use in gas-works; and he thought that next to this a calorific standard would probably be of more ready service for maintaining the gas of an equable character.

Mr. GRAFTON, in reply, said Mr. Whitelaw had remarked that he (Mr. Grafton) restricted the air supply. This was perfectly true; but he had omitted to note the simple way in which the gas was burnt to give the red-hot flame. It was not a question of stifling the air supply, but of burning the gas in an improvised way. In the place where he experimented, there was no trouble with draughts. From the red-hot flame he got a far greater radiation of heat than was obtained from an ordinary gas-fire. They did not want convected heat, but a beautiful glow, perhaps without the nuisance of smoke and such like. This was what he was aiming at. He was very much obliged to Mr. M'Leod for the kindly way in which he had dealt with the subject. He had sent round the Silber burner to let the members see it. It was not a bad burner; it was one about which there was some litigation with Mr. Sugg in bygone days. With regard to this particular burner, it had simply and solely been developed on the one idea. He had tried, as Mr. Carpenter had done, to establish that it was useless to build up an argand burner from the handling of the three air supplies. Mr. M'Leod was quite right in saying that the "London" argand No. 1 was often used to-day in preference to the "Metropolitan" argand No. 2 for testing carburetted water gas. In conclusion, Mr. Grafton expressed the hope that his lecture had been of service to the Association.

VOTES OF THANKS.

The PRESIDENT proposed a vote of thanks to Mr. Grafton, who, he said, had dealt with a subject which was of very special interest, not only to people connected with the gas industry, but to the public at large; and he had done it in such a manner that they would all benefit by his lecture when they had time to peruse it in the Technical Press.

Mr. GRAFTON having acknowledged the vote,

The PRESIDENT asked that a similar compliment should be paid to Mr. Vass and Mr. M'Leod for adjudicating upon the papers.

The request was cordially complied with.

Mr. J. FRASER proposed a vote of thanks to the President, for his services during his year of office.

The PRESIDENT assured the members that anything he had been able to do for the Association had been a pleasure to him. In attending the meetings he had gained what had more than recompensed him for any labours he had undertaken.

This closed the proceedings.

Presentation to Mr. William Maltster.

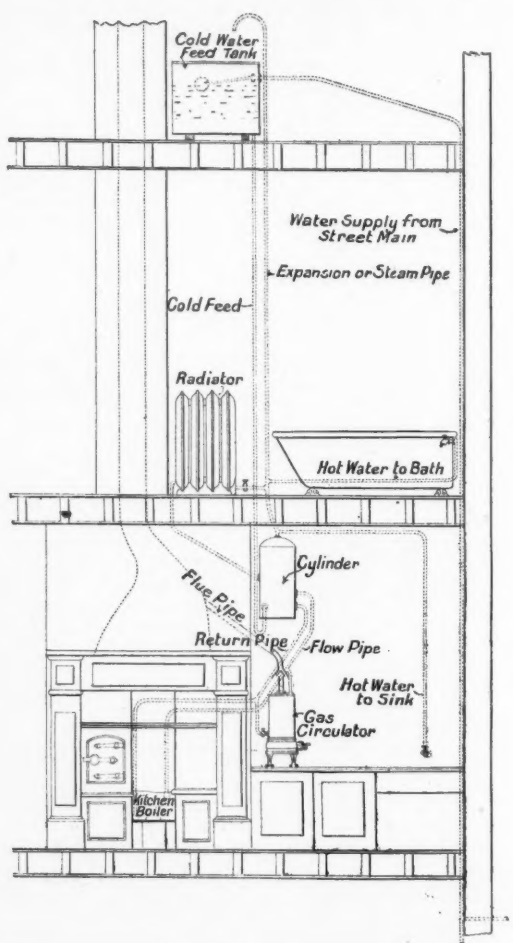
Mr. William Maltster, who for the last thirteen years has been principal foreman at the works of the South Suburban Gas Company, has just retired to enjoy the pension to which he is entitled under the Company's superannuation scheme. He has been in the service of the Company altogether about thirty-one years. Prior to his appointment as chief foreman, he had charge of the sulphate-works, where he carried out some important improvements, including the invention of a system of discharging the sulphate from the saturator, which is extremely ingenious and economical. Last Saturday, the employees of the Company met to say farewell to Mr. Maltster. The Engineer (Mr. S. Y. Shoubridge) presided, and was supported by the Workman-Directors (Messrs. Waller and Ross), the Assistant (Mr. J. W. Whimster), and others. Mr. Shoubridge said their meeting that day reminded them that the years were passing rapidly by, and that they were all fast hastening on to their journey's end. Mr. Maltster, who had gone in and out of the works every day for the last thirty-one years, would do so no longer, and they would all miss his familiar presence. By his long and faithful service, he had earned his right to rest and ease; and they were glad to know that the pension to which he is entitled would enable him to enjoy the remainder of his days in comfort and happiness. They did not suppose that Mr. Maltster was ever likely to forget his friends at Lower Sydenham, nor was it possible that those who had worked with him there would ever forget him. But they could not let him go without some tangible proof of their regard and esteem; and this had taken the form of a gold chain, which he hoped would serve to bind him to them for the rest of time. Before the presentation was made, Mr. Waller and Mr. Ross expressed the regard which they felt, and which they were sure all the employees felt, for Mr. Maltster, who they hoped would long be spared to enjoy the pension he so well deserved. In acknowledging the gift, Mr. Maltster said he could not find words adequately to express his thanks for all the kinds things that had been said of him, and for the handsome chain which had been presented to him. He should never forget their kindness, nor the happy time he had worked together with them.

WATER HEATING BY GAS CIRCULATORS.

After the proceedings reported as having taken place at the last meeting of the Yorkshire Junior Gas Association,

Mr. R. HALKETT, Assistant Superintendent in the Distribution Department of the Leeds Corporation, read a paper in which he dealt at length with the fixing and working of gas circulators. He was able to show a Wilson circulator in operation; and after explaining its advantages and capacity, he referred to the carrying out of internal fitting.

In many towns, said the author, all internal fitting is left in the hands of plumbers and ironmongers; but the gas undertakings would reap a veritable harvest if they undertook the control of such matters themselves. If, however, the gas suppliers cannot see their way to take over this department, some arrangement could surely be entered into by which fires and heaters, when fixed by local tradesmen, should be inspected and approved by an official of the undertaking. In this way, some check can be kept upon appliances being fixed where the conditions are unfavourable, upon faulty connections, for undue consumption of gas, &c. Where internal fitting is under the control of the gas undertaking, the work can be made as nearly perfect as possible, and gas appliances can be intelligently pushed. A good way is to get in touch with architects and builders in the neighbourhood. By their instrumentality, gas appliances, &c., can become more general, as they have frequent opportunities of recommending such things to probable consumers, when consulted by them, and people will often be guided by their advice. Then, again, with reference to new houses in the course of erection, builders and architects can be consulted as to the leaving of tees in suitable positions, when fixing up the flow and return pipes of an installation, so as to simplify the fixing of a circulator at any future time. Of course, a fixed charge would be allowed them for this consideration, after inspection by the undertaking.



In the case of fixing a circulator, it is essential that it shall be large enough to do the work demanded of it. All makers guarantee a certain size circulator to heat a given quantity of water; and therefore, when you know the quantity of water to be heated, it is an easy matter to ascertain the correct size of circulator to be used. Therefore the inspector, or the one supervising the job, will, on his first inspection of the work, note the size of the cylinder, the length of the flow and return pipes, and the conditions under which the pipes are placed, and so deduce the size of the circulator required. Heat is lost by radiation; and therefore the nearer the circulator is to the cylinder, the more econo-

mically it will work. In some installations, cold water has to be drawn off before any hot water is obtained; and considerable heat is lost in this way—the whole length of cold pipe having to be heated as the water travels. Therefore, from an economical point of view, this system is not to be recommended. If it is desired to estimate the cost of maintaining a constant supply of hot water, it is necessary to take the length of the flow pipe, and as 1 cubic foot of gas is equal to 3 square feet of heating surface per hour, it will be seen that an approximate length of 10 to 11 feet of 1-inch pipe can be kept sufficiently heated by 1 cubic foot of gas per hour. The amount used in different houses varies to a great extent, and it is impossible to consider this when estimating; but the above calculation will assist in giving an idea.

Explaining, by means of a sketch, the working of a hot-water installation on the cylinder principle, the author remarked that the flow and return from the cylinder to the boiler should have a gradual fall, and as few bends as possible. All sharp bends and square elbows (the latter particularly) are exceedingly detrimental, causing great friction on the flow of water; but it is sometimes impossible for them to be entirely avoided. Some installations are fitted up with iron pipes, and others with lead pipes. He prefers the latter where the water is hard, as lead pipes do not corrode. The drawback is that they are apt to sag, and thus become harmful to circulation. But this can be prevented by having them run on boards and fixed with clips, or supported by pipe-hooks, placed at regular intervals of not more than 18 inches apart. With a lead-pipe, a gradual sweep can be obtained, instead of a sharp bend as would be necessary with an iron pipe; and this would be of additional advantage to the circulation.

If the installation is in good working order, there is very little trouble in fixing the circulator to it. All supplies of water for domestic use should be taken off the top portion of the cylinder, or the expansion or steam pipe. When fixing the circulator, have the points chosen to which it is desired to connect the flow and return pipes, so as to be able to run them in such a position as to avoid as many bends and elbows as possible, bearing in mind that the fewer there are of these the better will be the circulation. After making the necessary connections, place the circulator and connect up to them. Either lead or iron pipes can be used to connect it to the flow and return pipes. Mr. Halkett prefers lead in this case also (unions, of course, being connected to the lead pipes with wiped joints), as often the distance for connecting is so limited that where iron pipe would throw a great strain on the connections to the heater lead pipe will yield in connecting up. A gradual rise, too, can be obtained with it, which is of great assistance to the circulation. Any bends or elbows used in connecting between the heater and the return pipe of the installation tend to make the circulation sluggish; and therefore it is advisable to make the connection in as direct a line as possible. If the main pipes are vertical, it is impossible to avoid one elbow or bend on the hot-water pipe, as this connection comes off the top. If all these points are carefully observed, there should not be any trouble with the water supply. The gas supply hardly calls for comment; but the supply should run direct from the meter, and nothing less than ¾-inch pipe should be used. The flue-pipe is a very important point in fixing a heater, as it has great influence upon the calorific value received by the heater from the gas. One great point to be observed is that the heater derives the full benefit of the gas before it enters the flue; and this is greatly controlled by the way the flue is constructed, and the conditions under which it has to be worked. Owing to the baleful influence of condensation, it is best to use sheet copper for the flue-pipe, as it will better withstand the action of the vapour.

Sometimes it is possible to go directly from the heater to the kitchen flue with only one elbow on the flue-pipe; but at others as many as three or more elbows are required. These two different methods of fixing would require different treatment. In the first instance, a baffle should be fixed to prevent the keen draught drawing away the heated gases before the heater has derived full benefit from them. For the second case, a baffle should not be fixed, unless troubled with a down-draught, because the number of elbows would make the draught sufficiently sluggish, and by the addition of the baffle it would be too sluggish in its action. Where there are elbows on a flue-pipe, there should be no square elbows, but obtuse elbows; for on every square elbow fixed, you lose a considerable part of the bore. When connecting the flue-pipe to the chimney flue, one should always get direct into the flue, and not into the pocket of the chimney; for if this should happen, the heat would strike directly on the woodwork of the floor above, with what might be serious results. The flue-pipe should not be extended through the pocket into the main flue; for it is possible after a time for the pipe to perish, and then the results would be the same as in the previous case.

A source of trouble with the flue-pipe, when the baffle is fixed, is the condensation. This condensation, which takes place in the flue-pipe, naturally runs downward, with the result that it drops on to the heater. To overcome this difficulty, makers have fitted a drip-box to the iron stand of the heater, and on the inside of the baffle have formed a channel, in which the vapour collects, and whence it is conducted by a ½-inch brass tube to the drip-box, thus dispensing with the dripping. In cases where no baffle is fixed, it would descend through the flue of the heater into the drip-box. The only preventive of this condensation is to keep the flue as warm as possible, so that the cooling process cannot take place. It can be covered with slag wool, or some other non-conductor; but in many instances this would be regarded as unsightly by the consumer. Almost a necessity to all heaters such as the circulator, would be a safety-valve fitted at the top.

These circulators can also be used to heat hot-water radiators for shops, halls, offices, &c., with great success. In calculating the consumption necessary in this case, or for heating hot-water pipes, each foot of gas will heat roughly 3 square feet of heating surface; and as there is roughly an area of 3 square feet in a double loop of a 36-inch radiator, each loop of a radiator requires 1 cubic foot of gas to keep it hot. But in this case, as in all others, it is advisable to have a little surplus heat at first, so as to heat up the water quickly, and then reduce the gas for maintaining the temperature afterwards. It is not wise to simply arrange for sufficient heat to maintain the temperature; it is necessary to raise the temperature quickly to begin with, and then, by means of a lever-tap or a thermostatic valve, to reduce the gas when the water is heated.

The paper was illustrated by a large glass-fronted working model, specimens of the circulators described (open, so as to admit of inspection), some loose parts of same, thermostats, gas burners and fittings, &c., lent by Messrs. Wilsons and Mathiesons, of Leeds.

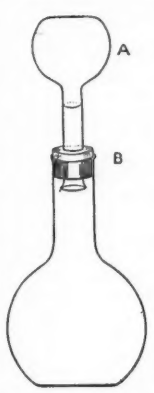
Following the paper there was a more or less informal succession of queries as to details of construction, fitting, costs, and applicability to various conditions which were described. Mr. Halkett is chief assistant to Mr. Hole at Leeds, and has had, both there and at other places, considerable experience in hot-water engineering and the application of gas thereto. He was consequently thoroughly at home in dealing with the questions that were put to him as to circulators, radiators, &c.; and a very profitable time was spent by the members.

ESTIMATION OF CARBON DIOXIDE IN GAS.

Modification of the Pettenkofer Method.

The current number of the "Chemical News" contains the following article, by Mr. Arthur Marsden, describing a modification of Pettenkofer's method for estimating carbon dioxide in coal gas.

A 50 c.c. graduated flask A is fitted by means of a rubber stopper B into the neck of a Jena flask C of approximately 600 c.c. capacity. The flask C is carefully dried and filled with gas by inverting it over the source of supply, and expelling the air by passing through five or six times its volume of gas. The flask A is filled to the mark with a solution of barium hydroxide, and brought under the mouth of the flask C, which is then raised above the open end of the supply-tube, and A is connected to C by means of the stopper. The solution in A is allowed to run into the flask C, and is mixed with the gas by vigorous shaking for five to ten minutes or longer; then 10 c.c. of the solution are withdrawn and titrated with standard acid, using phenolphthalein as indicator. The strength of the barium hydroxide solution should be approximately decinormal. After titration, the volume of acid used is subtracted from the titre number of 10 c.c. of barium hydroxide solution, the remainder being the volume of hydroxide which has entered into combination with the carbon dioxide. Knowing the volume of the gas, the number of cubic centimetres of barium hydroxide taken up, and the volume at normal temperature and pressure of carbon dioxide equivalent to 1 c.c. of the barium hydroxide solution, the percentage of carbon dioxide in the sample can be readily calculated from the formula—



$$P = \frac{E\,(B - A) \times 5 \times 100}{V}$$

P = Percentage of carbon dioxide in sample.
V = Volume of gas taken.
A = Volume of $N/10H_2SO_4$ required for 10 c.c. of the solution after mixing with the gas.
B = Volume of $N/10H_2SO_4$ equivalent to 10 c.c. of $Ba(OH)_2$.
E = Volume of carbon dioxide in cubic centimetres equivalent to 1 c.c. of the barium hydroxide.

In an estimation, the values obtained were—

V = 600 c.c. A = 8·0 c.c. B = 10·0 c.c. E = 1·119 c.c.

Whence—

$$P = \frac{1{\cdot}119\,(10 - 8) \times 5 \times 100}{600} = 1{\cdot}86$$

This method is accurate to the second decimal place when employed for gas containing more than 0·5 per cent. of carbon dioxide. If the gas contains either ammonia or sulphuretted hydrogen in more than traces, it must be removed before estimating the carbon dioxide.

The death occurred last month, at Exmouth, of Mr. Richard Darlington (at the age of 79), for thirty-two years connected with the Kent Water Company's works at Shortlands.

ILLUMINATING ENGINEERING IN AMERICA.

Further Views on Recent Progress.

In the last number of the "JOURNAL," we gave some extracts from an article by the Editor of our American contemporary "Illuminating Engineering," on the progress made last year in the lighting branch of engineering. In order to obtain a general review of the year's progress, a letter of inquiry was sent to a number of representative manufacturers and others; and the following are some of the views expressed.

Mr. E. N. Wrightington, the Second Vice-President of the Boston Consolidated Gas Company, said it was gratifying to note the decrease in the number of cases of flagrantly ill-arranged lighting systems, and the constantly growing number of installations laid out according to the best tenets of illuminating practice. They had had their share of these in Boston; and the outlook for a healthy growth in this direction was very encouraging. The inverted burner lent itself admirably to the most efficient arrangement, and supplied a long-felt want in this regard. It was very pleasing to note the rapidly increasing amount of satisfactory glassware made for use with gas-mantle lights of all kinds; and at present there was every reason to believe that the current year would see a supply suitable for every possible requirement of art or efficiency.

Mr. Irvin Butterworth, the Vice-President and General Manager of the Detroit City Gas Company, replied as follows: "I feel that there has been some progress in Detroit during the past year in applying the principles of scientific illumination. For instance, more attention has been paid to the distance between lights and their height from the floor. I believe also that the standard of illumination has been considerably increased; more light being demanded, and the users being more discriminating as to its quality and distribution. We installed a large number of so-called gas arc lamps last year, more than two-thirds of which were of the inverted type. We placed several thousand single inverted burners, and expect to place twice as many this year, which shows the tendency of gas lighting in Detroit."

Mr. W. J. Clark, the Vice-President of the Westchester Lighting Company, Mount Vernon (N.Y.), expressed the opinion that in no like period since the advent of the illuminating engineer had his art made such great strides as during the past year, particularly in the matter of gas lighting. This was markedly evidenced by the holding of a joint meeting of the New York Section of the Illuminating Engineering Society and the National Commercial Gas Association at the convention which took place in December last year. Mr. Clark considers that the gas industry is at length waking up to the importance of this great factor in the satisfactory growth and output of its community. A number of progressive companies have regularly employed men who are experts in illumination, and many of the gas companies who have not had their regular force of illuminating engineers are making a practice of calling in the services of these trained men in the solving of lighting problems. The Consolidated Gas Company of New York have done a very commendable work in the equipping of a building, under the direction of an illuminating engineer, with the latest gas lighting devices. Not only does it contain a very instructive demonstration as to what may be done in the way of the distribution and diffusion of light, but shows a clever manner of redistributing points for radiants where the gas-piping in old buildings was fixed at the time the building was constructed. Having this entire building at its disposal gives the Company an opportunity for demonstrating a great variety of lighting, such as would be useful in the home, office, and shop; the latter including a very beautiful window installation. Mr. Clark adds: "The progress made towards the perfecting of the inverted gas-mantle burner has given the gas man a new impetus in the lighting field, and has made possible the adapting of a more sightly and ornate, as well as more useful, fixture, than was possible with the upright mantle burner."

The Manager of the illuminating engineering laboratories of the Welsbach Company, of Gloucester (N.J.), Mr. Norman Macbeth, replied that the progress made last year in illuminating engineering in the field in which the Company are particularly interested was beyond their most sanguine expectations; and he said the outlook for the current year was particularly bright. Whatever doubt may have existed as to the value of illuminating engineering as applied to gas sources has, in his opinion, been thoroughly dispelled. The inverted lamp and its accessories has to a greater extent than the upright one been made a subject of illuminating engineering study and application. The output of these lamps now exceeds 70 per cent. of that of the regular uprights which have been on the market for more than twenty years—that is to say, of the Company's output in lamps consuming upwards of 3 cubic feet of gas per hour, 40 per cent. are reflex. "Illuminating engineering," said Mr. Macbeth, "requires that we should have a variety of lamps to properly meet the varied conditions imposed on us by service. The day has passed, if it was ever here, when any one lamp or type of lamp could be considered a panacea for all the ills presented in the broad field of artificial illumination. Extensive research has been under way for several months along the lines of standardization, not only of mantles, for efficiency, colour, and life, but of burners, to determine the equipment which will give the best results for any particular set of gas conditions, of pressure, and so forth. The information secured is startling in many of its phases, and, with proper application, will do a great deal to advance the better kind of incandescent gas illumination. Investigation along these lines is of vast importance to the gas industry at large, and represents an enormous amount of original work, as little of the work reported in the past has been systematic."

COAL-TAR COLOURS—TINCTORIAL INDUSTRY.

At the recent Annual Meeting in Manchester of the Society of Dyers and Colourists, the retiring President (Professor R. Meldola, F.R.S.) delivered an address on "Tinctorial Chemistry—Ancient and Modern." In it, he referred to the development of the coal-tar colour industry in connection with dyeing; his remarks (for which we are indebted to the "Chemical Trade Journal") being as follows.

Previous to the Perkin era, dyeing and calico-printing establishments were not so dependent upon coal-tar colours as at the present time, but had to rely upon a limited number of vegetable dyestuffs. These primitive dyestuffs in about half a-century have been supplanted by the introduction of hundreds of coal-tar derivatives. Such a revolution in a venerable industry in so short a period has never been witnessed in the progress of science, In his opinion, the rapid increase in the manufacture of coal-tar dyes was due to the development of the science of organic chemistry. From the discovery of mauve by Perkin, it had been nothing but science all along the line; and by science he meant the determination of the chemical constitution. Research was necessary; and the discovery of new materials to help the manufacturer was the business of scientific research.

Professor Meldola next dealt with the period of fifteen years—1870–1885—in the development of the colour industry. He said that after the Franco-Prussian war of 1870, it was seen that the Continental manufacturers began to reorganize their industries; and some ten years later we in this country experienced the first symptoms of serious competition. About 1870, the list of known aniline dyes was limited, and a good green for dyeing was unknown. At the time of his connection with the industry in 1877, he saw the change that was coming over the industry; and on his severing his connection with it in 1855, the change had progressed with such speed that he foresaw the approaching decline of our supremacy in the colour industry. The period from 1870 to 1885 was almost given over to the discovery of new types of colouring matters. It was this or the ascertainment of the chemical constitution of the old ones which preceded industrial developments. During a period of thirteen years, twenty-four colouring matters were discovered—some ultimately displacing dyestuffs, the manufacture of which alone had been keeping some of our works going.

The Professor then traced the new discoveries down to synthetic indigo in 1880, and again emphasized the point that chemical research was the prime factor in the development of the coal-tar industry. He said the period of fifteen years he had been discussing was the commencement of the stagnation and decay of the British coal-tar industry. Most of the discoveries were made abroad, and the English contribution to the industry was quite insignificant as compared with Germany. It was amazing that there was any doubt that the secret of the other countries' success was "Research," writ large. It was true that when the facts of the new discoveries became noised abroad, a few of our manufacturers began to adapt themselves; but research chemists were lacking. He happened to be one of the few; but what could three or four do against scores who were working under favourable conditions, and who were highly trained University men? Our faulty patent laws and restrictions on the use of industrial alcohol were not entirely to blame. The blame should be laid on our neglect of science. Instead of attributing the decline of our colour industry to the imperfection of our patent laws, it should be laid against our want of initiative. At the period referred to (1870-1885), the German patent laws were also very faulty, and some of the older German discoveries of colours were never patented, but were worked in secret.

In conclusion, Professor Meldola pointed out that the great industry on which they now depended for their colouring matters was but a transitory phase in the history of applied science. Our coal seams would not furnish everlasting supplies; and sooner or later the end must come. It was a matter of a few centuries, and then the supply of coal tar would cease. The same remark applied to petroleum and mineral oils.

Producer-Gas Fired Furnaces.—We have received from Dr. Oskar Nagel, Consulting Chemical Engineer, of New York, a copy of his work on the above-named subject. It contains detailed descriptions and illustrations of practical producer-gas fired furnaces employed in the chemical, metal, metallurgical, and other industries. It is a handbook for the use of engineers, chemists, manufacturers, superintendents, and students; and the text is fully illustrated. We shall take an early opportunity of noticing it more fully.

PROTECTING WATER-WORKS FROM LIGHTNING.

A report on the subject of the protection of water-works from lightning, with special reference to the requirements of those of the Birmingham Corporation in the Elan Valley, has been made by Sir Oliver Lodge, F.R.S., the Principal of the Birmingham University.

According to an abstract of the report contained in a recent number of the "Electrician," in water-works the chief danger to be apprehended from lightning, apart from ordinary house risks, lies in the possibility of the dams being struck and the shock conducted to the centre of the dam, where unseen damage might be done; while, even if the flash escaped by metal paths to the water underneath the lake surface, the shock would be as great as that caused by a small charge of dynamite placed in the same position. Protection, therefore, involves one of two things: Either keeping the lightning to the surface without letting it penetrate into any interior, or taking care that, if it does so penetrate, it shall have plenty of metallic surface by which to reach the water in a quiet and unexplosive manner. In achieving either or both of these ends, it is natural and proper to take advantage of any metal work already existing for other purposes; indeed, all such metal work must be taken into account, whether it constitutes a source of danger or a means of protection.

In regard to exposure and relative altitude, it might be thought that water-works such as these, being in a valley and surrounded by hills, would be fairly well protected by Nature. But this is not the case. In a mountain district, lightning has often been known to strike down ravines; and any part of a valley may be struck, though, of course, the likelihood is less in some places than in others. Moreover, it must be remembered that a flash, if a strong one, is often by no means a simple linear discharge, but that it may be, as it were, a "bush" or number of flashes, striking a number of points simultaneously or in rapid succession—the occurrence of one discharge weakening the air and making another, for the moment, more easy. Whenever a violent flash occurs, it always means some danger; and if a flash can be avoided by relieving the strain through a sufficiency of quiet point discharges, that is the best plan. Such point prevention is always aimed at, though not always achieved.

Sir Oliver then goes on to describe the actual steps that should be taken for the protection of the water-works. At the Craig Goch tower dam, which is perhaps the most important part of the works, there are a number of pipes which might be used for protection purposes; but it is thought better to keep the lightning outside the tower. Ordinary arrangements might be used at the top; but, owing to the fact that the level of the lake alters by as much as 40 feet, it is recommended that the north face of the tower, from a foot above high-water level to as far down as can readily be managed, should be covered with sheet copper, and that similar sheet copper should extend as a horizontal band 1 foot wide round the five most northerly of the octagonal faces of the tower, just above high-water mark. It is recommended that a copper ribbon or tape should be run up each of these five northerly faces, and be thoroughly joined to the copper dome at the top and to the copper band at the bottom. It is also suggested that a ring or crown of points be placed round the copper dome of the tower, each point protruding about a foot clear from obstruction.

At another tower it will be necessary to connect electrically the upper dome with the rest of the tower—the same arrangements being used at the base; while on a third the existing rain-water pipes can be adapted for use in this connection. At one of the other dams there is danger owing to the fact that hydraulic pipes are sunk in the interior, which might be affected if lightning struck the dam tower. It is therefore proposed to fix a point erection on at least one, or preferably on four, of the six pillars on which the tower is supported. All these erections are to be connected by a tape, which will be led away to the sixth pillar, which is on the up-side of the dam, whence it can be led into the water. The band at this point should be at least 6 inches, and rolled up at the bottom, so that it can be led down to lower levels if necessary. Other buildings and structure require only the usual protection; and for this purpose lead-covered iron rope is recommended.

In conclusion, Sir Oliver Lodge points out that if some kind of moored floating buoy can be arranged, especially if it happens to be considered as easy as fixing copper sheet below water-level, then it would be preferable, as being electrically better. The buoy would have a flat horizontal sharp-edged rim, and points all round, on a level with the water; and a copper rope connection would come up to it under water. One special advantage of a floating arrangement is that it would automatically make-contact with the water without attention; whereas by the copper-sheeting plan a rapid lowering of the lake at some future time might leave the conductor hanging free above the water, unless it were remembered to send and unroll and fix its continuation as the water sank.

Last week's issue of "John Bull" contained the following: "We hear a funny story about the City of London Electric Lighting Company at Bankside. The Company advertise their electric radiators for heating purposes; but one of our readers says he has just fitted up their own offices with hot-water pipes, which are hidden under the floors in cases. No doubt there is another side to the question; and we should like to hear it."

WATER SUPPLY AND FILTRATION STATISTICS.

At a recent Meeting of the Institution of Civil Engineers, a paper entitled "Some Notes and Statistics on the Sheffield Water Supply," was read by Mr. L. S. M. Marsh, and also one dealing with "Statistical and Experimental Data on Filtration," by Mr. W. R. Baldwin-Wiseman. The following are abstracts of the communications.

The first part of Mr. Marsh's paper dealt with the population of the district of supply, and the various quantities of water used for domestic, trade, and other purposes; and it furnished information as to methods of supply and the prevention of waste. It also dealt with the monthly, daily, and hourly variations in the supply—tables and diagrams showing the averages of the last recorded year as compared with the average over a series of years; and some particulars were given of a metered supply to a small block of cottage property. A tabulated statement showed the actual delivery through large trunk mains and the smaller service-pipes, with their lengths, and also the loss of head. With these were given the results of some experiments connected with the discharge from hydrants, fire-hose, and jets of various diameters, with different heads, and also the discharge and loss of head in lengths of lead pipe, both with open ends and with stop-taps attached. The length of this lead pipe might be taken to approximate roughly to the ordinary length of a communication-pipe; and two experiments were given to show the force of the concussion when a tap on such a pipe is suddenly closed.

The second part of the paper dealt with the quantity of water flowing off the Redmires watershed. The author showed what portion is utilized, wasted, evaporated, or absorbed, &c.; and a table was furnished covering the period from 1879 to 1907. The particular drought of 1904-5 (May, 1904, to January, 1906) and that of 1887-8 (February, 1887, to January, 1888) were analyzed in the same way, showing the monthly quantities, as well as that of the year 1901, showing weekly quantities—these being periods when no water flowed to waste. Other tables gave the rainfall, evaporation, and absorption discharge from the watershed, &c., at the break-up of the drought of 1901; the maximum discharges over the waste-weirs, and particulars of the reservoirs and drainage areas; and yearly and monthly rainfall at Redmires.

The author discussed the bearing of these tables on the usual practice of engineers when considering rainfall and the resultant flow from watersheds during a period of three consecutive dry years; and the paper concluded with a short description of the method adopted for the prevention of the action of water on lead, with an illustration showing the apparatus specially designed for the purpose. A diagram of the water stored in the reservoirs and the weekly rainfalls for 1884 to 1907 accompanied the paper.

Mr. Baldwin-Wiseman's paper opened with a brief introduction in which he pointed out the urgent necessity for a detailed survey and a strict conservation of the water resources of the country, if good and adequate supplies are to be afforded to the steadily increasing population, and to the numbers likely to be inhabiting the land in the middle or the end of the present century. He next discussed the natural purification of streams, and referred to the several contradictory opinions and researches which have been published from time to time. He subsequently outlined the history of the researches upon slow filtration through sand; touching incidentally upon sedimentation and the development of methods of chemical and bacterial investigation of waters intended for public supply. He described at length his own experiments on the rate of flow of water through various thicknesses of British filter-sands, and the loss of pressure in them, and elaborated a formula connecting the rate of flow of water through any bed of sand under a constant difference of pressure with the superficial extent of the grains of sand and the volume of water retained by the sand. The author concluded with a general review of modern improvements in the operation and construction of slow sand filters, the advantages and the disadvantages of various types of mechanical filters operated with or without coagulants and settling-basins, and the methods of chemical purification subsidiary or auxiliary to filtration.

The death is announced of Mr. George Newell. Deceased, who was 72 years of age, was a native of Aldershot, and for about 43 years he was Manager of the water-works belonging to the Aldershot Gas and Water Company. For five years previous to that he had been in the employ of the Company; so that he had worked for them for 48 years in all. He leaves a widow, six daughters and five sons. He was taken ill just before Christmas, and a short time ago pneumonia supervened, from which he never recovered.

The many friends of Mr. J. Tysoe, the Engineer of the East Greenwich station of the South Metropolitan Gas Company, who, as already announced in the "JOURNAL," some weeks ago left England with Miss Tysoe for Egypt for the benefit of his health, will learn with satisfaction that he is now well on the way to complete restoration. He booked passages for himself and his daughter by the P. and O. steamship *Malwa*, which was due to leave Port Said on the 27th ult.: intending to break the journey at Gibraltar, and spend a week or two in the South of Spain, or possibly go on to Teneriffe, in order that he may get thoroughly well before reaching home.

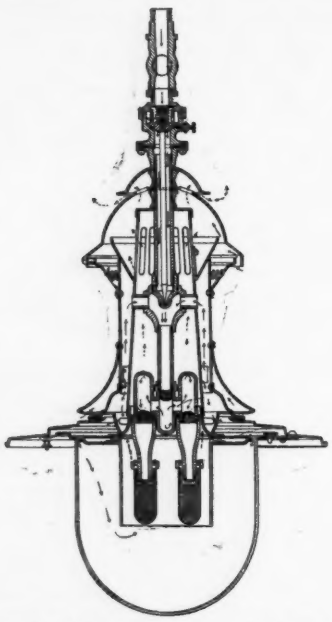
REGISTER OF PATENTS.

Incandescent Street-Lamps.

DARWIN, H., of Gravelly Hill, near Birmingham.

No. 3634; Feb. 15, 1909.

This invention has for its object "to provide an incandescent lamp capable of developing a maximum illuminating efficiency when worked with gas at low or ordinary pressures, and can therefore be used with great economy, as regards gas consumption, for lighting services that can at present only be performed, at considerable expense, by the use of high-pressure gas."



Darwin's Regenerative Incandescent Gas-Lamp.

The lamp is constructed so as to admit of the regenerative utilization of the heat of the products of combustion from an enclosed inverted burner, or from an enclosed cluster of such burners, in such a manner as to induce a continuous and ample supply of superheated and uncontaminated air both to the parts of the system in which the combustible mixture is formed and delivered to the burners, and also to the enclosed combustion area.

In the application of the invention to a street-lamp as shown, the burners are enclosed within a globe attached to, and having free and direct communication with, the lower part of a metallic flue or shaft whose upper part leads into, and terminates in, a cowl or hood having openings or perforations through which the products of combustion from the burners can escape or are discharged into the atmosphere after the heat therefrom has been regeneratively utilized. The shaft or flue is made to enclose the whole of the parts provided for supplying gas and air to the lamp, and for forming the properly-proportioned and intimately incorporated or atomized mixture for consumption at the burners, while the middle part of the shaft is surrounded by a metallic jacket or casing, from which it is separated by an annular air-space or air-heating chamber.

This chamber has communication, at its upper part, only with the air supply system of the burners and, at its lower part, with the combustion area or burner space within the globe; while its outer walls are provided with suitable orifices or openings for the admission of atmospheric air, part of which is utilized for forming the combustible mixture that is consumed at the burners, and the other part for "promoting perfect combustion" of the mixture.

The whole of the air admitted into the jacket or chamber is subjected to a preliminary heating by contact with the external walls of the inner shaft or flue which are maintained at a high temperature by the heated gases ascending from the burner; and, in addition, both parts of the air are subsequently superheated by the direct regenerative utilization of the heat from the gases.

To provide for this, as well as for promoting an injector action on the gas supply, the admission orifices into the jacket or heating chamber are arranged at a suitable point between the upper and lower ends of the jacket, but preferably nearer to the bottom than the top, so as to remove them as far as possible from the cowl or hood where the products of combustion escape, and thus ensure that the air drawn into the jacket shall be as pure as possible and uncontaminated by the vitiated combustion gases discharged from the lamp.

Incandescent Gas-Burners.

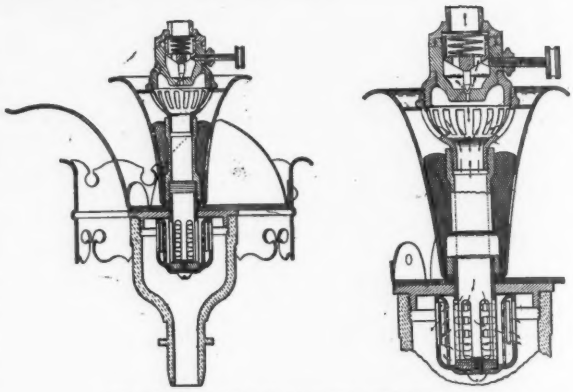
DARWIN, H., of Gravelly Hill, near Birmingham.

No. 4609; Feb. 25, 1909.

This invention has relation to inverted incandescent gas-burners of the type in which there is interposed between the gas-service pipe and the gas and air induction tube a gas-regulator, which is operated externally by a screw or other mechanical device, for the purpose of varying the area of the gas-passage into the induction tube, and thereby adapting the burner to suit the particular supply pressure or the richness or character of the town gas to be burnt in it.

The object of the invention is to provide an improved burner which embodies a regulator of the type above referred to, and is adapted to produce a thoroughly atomized and perfectly combustible mixture of gas and regeneratively-heated air, and to deliver the mixture to the point of ignition in such a condition that, when burnt in contact with an incandescent mantle, the maximum illuminating value of the gas is attained.

The regulator is constructed so as to deliver the gas in a vertical straight line or axially into an induction tube, which is supplied with regeneratively-heated air from a closed or sealed hot-air jacket surrounding the induction tube; the gas and heated air being thence conveyed to an atomizing and mixing device enclosed within a mixing-chamber communicating with the burner-nozzle.



Darwin's Inverted Regenerative Gas-Burner.

In one application of the invention (as shown), the burner comprises an adjustable gas-regulating valve in communication with the gas supply, an injection tube leading from the valve to an expansion and mixing-chamber and having a system of air inlets at its upper end, and an air-heating chamber formed by a perforated jacket or casing which surrounds the injection tube, but is separated from it by an annular air-space and is arranged within the hot region above the burner flame, whose heat is utilized regeneratively for heating the whole of the air supplied to the mixing-chamber and for superheating the mixture, so that it is delivered to the point of ignition "under conditions which ensure perfect combustion."

The first illustration represents a complete vertical section of a single-light inverted incandescent gas-burner constructed in accordance with the invention; and the second one represents, upon an enlarged scale, a vertical section of part of the burner, showing more clearly the construction and arrangement of the gas-regulator, the air inlets, and the atomizing or incorporating devices of the mixing system.

Vertical Retorts.

HERRING, W. R., of Edinburgh.

No. 5362; March 5, 1909.

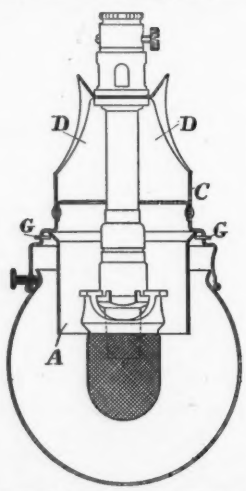
This invention, relating to improvements in, or connected with, feeding and discharging apparatus for gravitation retorts of the closed type, is fully described and illustrated on p. 33.

Inverted Incandescent Gas-Burners.

MANNESMANN, C., of Remscheid-Bliedinghausen, Germany.

No. 5576; March 8, 1909.

This invention relates to a removable draught inducer or chimney for inverted incandescent gas-burners of the particular construction shown.



Mannesmann's Incandescent Burner Chimney.

The lower edge of the part A of the chimney reaches down exactly to the point where the tissue of the mantle commences; so that, on the one hand, all the products of combustion are led off by the chimney, and, on the other hand, the illuminating power of the mantle cannot be

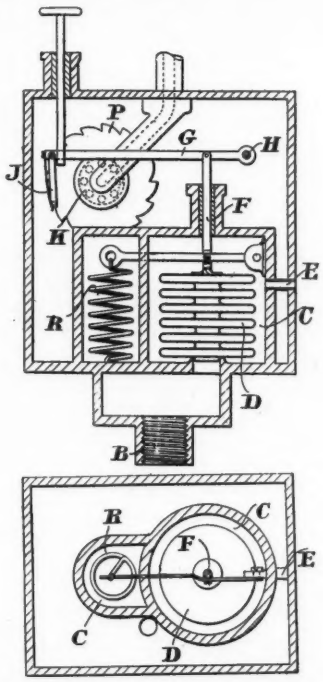
affected by being partly covered up by the chimney made of non-transparent material. The part A is connected to an upper part C, which serves as a flue, by means of two pins G, which engage the conical upper edge of the chimney. The upper edge of the flue is secured to the gas-supply pipe underneath the mixing-chamber, and is provided with two large lateral openings D, through which the products of combustion are "effectively discharged"—the upper flanges on the openings preventing them from entering the mixing-chamber.

Automatic Gas Lighting and Extinguishing Apparatus.

MACKAY, J., of Bradford.

No. 5918; March 11, 1909.

This automatic gas lighting and extinguishing apparatus has an expansible and collapsible metallic element connected with the controlling means of a gas-burner, and placed externally to the element; so that when an impulse due to a temporary change of pressure comes upon the mains, the element moves vertically and returns to its original position, having operated the controlling means to admit or prevent the access of gas to the burner. It is, however, possible to provide external means, if desired, whereby the apparatus may be operated without sending a pressure impulse through the mains, when it is required to test the burners individually.



Mackay's Automatic Gas Lighter and Extinguisher.

In one construction (as shown), a closed chamber is put in communication with the main pipe B. Within, or partitioned off from, the chamber is a small inner chamber C, in which is a closed expansible pipe D, made of thin metal with deep corrugations in planes at right angles to the axis of the pipe (after the manner of a concertina). One end of the pipe communicates with the main; so that the interior of D is subjected to the pressure which obtains in the mains. The space of the chamber C (outside the corrugated pipe) is, however, in communication with the atmosphere, either by a pipe E or a hole drilled through the wall. At the closed end of the pipe D a rod F is attached, which extends through a stuffing-box into the outer chamber, where it is attached to a lever G, pivoted at one end H, and which carries at the other end a pawl J, adapted to operate a step-by-step valve K. The pipe D is loaded by a spring R, attached to the bottom of the inner chamber, acting through the medium of a lower lever attached to the rod F which actuates the valve K through the lever G. The spring R may be replaced by weights placed on top of the pipe D itself. By thus loading it, the pipe is prevented from operating the valve K until a predetermined pressure above the normal has been attained—say, 9 lbs., when the normal working pressure is 7 lbs. per square inch. Means may be provided for preventing the ratchet wheel P, or other driven part of the controlling device, from moving under the effect of momentum if an impulse causes the pawl J to operate with excessive suddenness.

Heating, Cooling, Purifying, or Enriching Gases.

BLAKELEY, W., of Ravensthorpe.

No. 8481; April 8, 1909.

This invention relates to apparatus by which a stream of gas can be passed over the surface of a liquid, "for the purpose of heating, cooling, or distilling the liquid, or for the purpose of heating, cooling, purifying, or enriching the gas." The apparatus is of the type comprising a tower containing a series of shallow trays with intervening deflecting plates; each tray being provided with a central opening, through which the liquid falls on to a lower deflecting plate, and through which the gas rises into the space between the tray and the next higher deflecting plate—the gas and liquid being thus brought into contact.

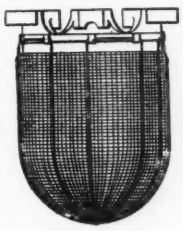
The arrangement was described and illustrated in the "JOURNAL" last year (Oct. 26, p. 246).

Incandescent Mantles.

HALL, F. H., of Wolverton Fields, near Stratford-on-Avon.

No. 6027; March 12, 1909. No. 10,376; May 1, 1909.

This combined invention consists: (1) In an inverted incandescent mantle tied or sown in the usual manner to its holder, and having constructed around it a frame of metal so arranged as to touch the mantle and take the bulk of the weight of the same. (2) In an inverted incandescent mantle in which the fine wire of which the supporting frame is composed is looped beneath the mantle and secured to the supporting ring to which the mantle is attached in any suitable manner. (3) In a process of strengthening such a mantle, according to which the mantle, after stiffening, or a dummy mantle, is utilized as a mould over which fine strips or threads of metal or other suitable material are passed to form a support for the mantle. (4) In an inverted mantle having a support of fine wire or other material, in which both mantle and support assist each other as regards maintenance of shape. (5) In a supporting attachment for inverted incandescent mantles as at present manufactured, according to which a ring separate from the supporting ring of the mantle is provided with points of attachment for the fine wires or other supporting material.



Charging and Discharging Gas-Retorts, &c.

MASTERS, E., of Palace Chambers, Westminster, and HANSFORD, J., of New Barnet.

No. 9057; April 16, 1909.

This invention relates to apparatus for delivering coal to, and simultaneously discharging coke from, gas-retorts and the like, of the kind in which there is used a combined charging and pushing member vertically adjustable and carried by a supporting frame having a wheeled base that can be traversed in front of a bench of retorts. It consists of improvements having for their objects "to minimize as far as possible the power required for the apparatus to perform its functions effectively, and, while making the construction as simple as possible, to economize the necessary working room and cost."

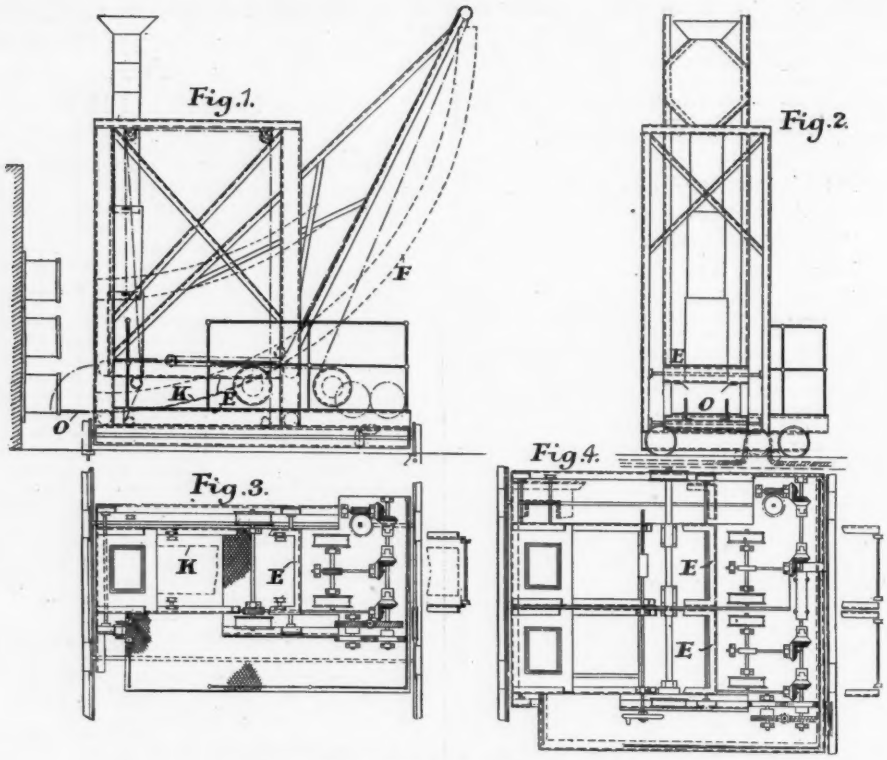
The invention is illustrated diagrammatically. Fig. 1 is a side elevation of apparatus having a single charging and discharging member that assumes a curved form in a vertical plane when in a position withdrawn from the retort. Figs. 2 and 3 are a front elevation and plan (parts of the apparatus being removed). Fig. 4 is a part plan of a similar apparatus with the charging frame in duplicate.

In figs. 1, 2, and 3 (p. 52), the main frame of the apparatus consists of channel shaped or other uprights joined together at the top and connected at the bottom to a wheeled base. On the top of the frame is a measuring hopper of the ordinary kind, into which the coal is delivered. Adapted to be guidably moved up and down in the uprights is a second or charging frame E, provided with guide-rollers that engage the outer frame. The frame is raised and lowered by ropes or chains which pass over guide-pulleys to winding drums driven by suitable gearing. The frame E carries the charging and discharging member F (in broken lines) and other parts of the apparatus.

One end of the combined charging and discharging member slidably bears, in the normal position, exterior to the retort, on a comparatively short platform K carried by the charging frame; the other end being elevated and supported by ropes or chains, which pass over guide-pulleys or the like, mounted on parts of the charging frame. These chains may be carried over winding drums and thence back to the end of the charging member. When the drums are revolved through gearing, the elevated end of the charging member may be lowered or raised, and in this way is made to assume a curved form in a vertical plane when its end is elevated; the platform K below it being likewise curved to act as a guide or support. Generally the form assumed would be a quadrant of a circle.

Hinged to the front part of the charging frame is a counterweighted apron plate O; normally in a vertical position and of such a size that it can, when turned substantially horizontal by the movement of the charging member, be pushed into the mouthpiece of the retort. The foremost push-plate, which is preferably of stronger construction than the others, is adapted in the customary way to close the lower end of the charging member, and (as the member travels through the retort) push the coke lying on the floor in front of it.

When it is desired to charge a retort, the apparatus is brought into position immediately in front. The lower end of the charging member having been made to register with one of the retort mouthpieces by raising or lowering the charging frame E, coal from the hopper is discharged through the shoot into the pockets of the charging member, the upper end of which is simultaneously lowered, with the result that its lower end slides forward on the platform, pushing the front counterweighted apron plate down and into the retort mouth over which the member glides and then passes over the floor through the retort, carrying the coal with it. During the forward movement of the combined charging and pushing member, the foremost push-plate encounters the coke lying in the retort, and pushes it forward, until it falls out through the discharging aperture at the further end in the usual way. When all the coal loaded in the charging member has been deposited in the retort, the member is withdrawn by imparting a reverse movement to it, and during this movement the push-plates take, or are given, an inclined position so as to pass over and spread the coal evenly on the retort floor. The apparatus is then ready for the operation to be repeated. By suspending the charging member in the way proposed,



Masters and Hansford's Retort Charger-Discharger

"a component of its weight will aid in pushing forward the coal and coke along the floor of the retort."

When the apparatus is constructed in multiple (for operating simultaneously on two or more retorts in line), the charging frames are placed side by side, as shown in fig. 4, and are connected together by a shaft or spindle provided with screws working in nuts carried by the respective charging frames and adapted to be actuated for adjustably spacing the frames apart, in order that the ends of the charging members may register with the mouthpieces of the retorts with which they are to co-operate. In such multiple apparatus, the shafts of the winding drums employed for raising and lowering the charging frame are provided with slidable roller bearings, and the sets of gearing for raising the charging members F are connected with each other by slidable couplings.

Manufacturing Incandescence Bodies for Gas-Burners.

HADDAN, H. J.; a communication from Bruno-Patente-Verwertungs G. m. b. H., of Berlin.

No. 12,466; May 26, 1909.

This invention relates to the manufacture of incandescence bodies (for gas-burners) from artificial filaments, to which the requisite salts of the rare earths are applied in the form of solutions, as in the case of incandescence bodies of cotton and other vegetable fibres.

The impregnation of incandescence bodies of artificial filaments does not, the patentees state, in itself present any difficulty; but considerable difficulties have been encountered in the burning of such bodies, owing to the absence of a strong skeleton of ash, and to the conversion of nitrates into oxides, accompanied by swelling injurious to the structure. To obviate this, it is essential to arrange that the formation of oxide is not due solely to the action of the flame, but is at least in part procured in advance with the aid of suitable chemical reactions. In this way, there is formed a skeleton, consisting of the oxides or hydrates of the salts, which very quickly bakes or fuses together in the flame and gives the necessary strength to the structure.

Well-known processes for this purpose are those of Blasco de Lery and Plaissetty. Blasco de Lery treats with ammonia incandescence bodies manufactured from artificial filaments, to the substance of which the salts have been added prior to the squirting; and by this means he converts the nitrates into hydrates. The latter are transformed by the burning into oxides. The process of Plaissetty hardly differs at all in its chemical aspect from that of Blasco de Lery; the only material difference consisting in the fact that the salts are embodied with the finished fabric by impregnation. Plaissetty, in the description of his process, mainly emphasizes the removal of the acids, by treating the hardened dry structures with aqueous solutions of alkalies —principally ammonia—so that easily soluble alkaline nitrates are formed. The separation of the acids is, however, inevitably accompanied by formation of hydrates or oxides of the salts; and it is precisely this latter chemical process which is essential for the production of durable structures. The process of Plaissetty is, therefore, as regards its effect, equivalent to the process of Blasco de Lery, and as regards the mode of operation the processes are also similar, inasmuch as in both cases the nitrates are converted into insoluble compounds by treatment with alkalies.

The process of Plaissetty, however, has the disadvantage that the impregnated bodies must be thoroughly dried before treatment with alkalies. Otherwise, before the reaction of the alkalies with the nitrates, part of the nitrates goes into solution and is lost as regards the illuminating effect of the body.

In the treatment of the dried, unburnt bodies with alkalies, the further disadvantage arises that the reaction takes place comparatively slowly, and the externally formed layers of oxide or hydrate sometimes prevent complete action of the alkalies on the nitrates. In this case, "swelling is inevitable when the structure is ignited, and distortion frequently results."

The present invention is said to obviate these disadvantages, and "provides incandescence bodies of great strength, great uniformity of structure, and, consequently, of uniform illuminating power."

The process of manufacture, according to the present invention, differs from that of Blasco de Lery in the fact that the salts are applied to the fabric by impregnation. The difference as regards the process of Plaissetty consists in the fact that the final treatment is not performed on the hardened, dried bodies, but on the moist bodies, as they come from the centrifugal apparatus in which the excess of impregnating liquid is removed. By performing the final treatment with application of heat, reaction throughout the entire mass is ensured. The process differs from both the prior processes referred to in the fact that the reactions do not produce (or at least not mainly) hydrates and oxides, but basic double compounds of the metals of the rare earths.

The bodies impregnated with salts are treated in a bath at a temperature of about 40° or 50° C. The bath consists of a mixture of alkalies or amines and acids—such as benzoic acid, chromic acid, salicylic acid, oxalic acid, hydrofluoric acid, hydrochloric acid—which are capable, with co-operation of the bases, of converting the nitrates into basic double compounds. Acetic acid and other organic acids may also be used; also phenols. The alkalies or amines used must form volatilizable compounds with the acids and with the nitric acid of the salts. The formation of the basic double compounds is materially favoured by immersing the moist fabric in the heated solution of alkali or amine at the moment at which the acid is added, and at which considerable heat of formation is evolved. The conversion of the nitrates into insoluble or nearly insoluble compounds takes place almost instantaneously, so that no lixiviation of salts can take place. If the alkalies or amines are present in excess, the basic double salts are more or less converted into oxides or hydrates. The employment of an excess of alkali is, however, not necessary, since when the body is ignited the basic double salts are converted into oxides of the rare earth metals without swelling, since the acids used are all easily vaporizable.

A suitable immersion bath is prepared as follows: 2 kilos of crystalline oxalic acid are dissolved in 20 kilos. of distilled water at 70° or 75° C. To this solution are added 10 kilos of liquid ammonia. The incandescence bodies produced are asserted to be of "great tensile strength, capable of bearing 50 to 60 grammes, and are elastic and flexible."

Since the final treatment takes place *in statu nascendi*, the chemical reactions are, it is claimed, very rapid. Consequently there is no loss of rare earths; and the bodies are of uniform composition, and also characterized by uniformity of lighting power. The rapidity of the reactions is increased by the treatment of the bodies in a somewhat moist state, as described.

It has heretofore been proposed, the patentees point out in conclusion, in the manufacture of incandescence bodies, to precipitate the thorium and cerium salts by an organic base or a mixture of organic bases, and also by peroxide of hydrogen used in conjunction with organic acids and their salts; the function of the peroxide of hydrogen being to produce thorium hydrate, and the function of the acid or salt

being to convert the cerium salts into an insoluble compound. In the present invention the bath does not contain hydrogen peroxide, and converts the nitrates into insoluble basic compounds.

Inverted Incandescent Gas-Mantles.

NEMEROVSKY, J. M., EVERETT, L. C., and NEMEROVSKY, F., of Manchester.

No. 14,176; June 16, 1909.

This invention refers to the ring or support to which the mantle proper is attached, and also to the method of attaching the textile material to the ring, so as to prevent the woven material from breaking away from its support. The patentees claim: "In inverted incandescent gas-mantles a flange or projection formed around the lower portion of the ring or support in combination with loops or links connected to the woven or textile material or mantle proper for attaching or supporting the textile material to the flange, or to a projecting portion of the ring below the flange, or to hooks below the flange."

Securing the Doors of Retorts, Coke-Ovens, &c.

RIECKE, P., of Dessau, Germany.

No. 15,276; June 30, 1909.

This invention has for its object to overcome the danger of the incandescent material being automatically discharged while the door is being opened (for instance) in the case of inclined retorts, although the arrangement is more applicable to coking-ovens.

According to the invention, one or more locking or clamping bars are mounted on the door plate and adapted to be rotated in the plane thereof so that their ends engage hook-like members or catches disposed in a plane at right angles to that of the door; the locking bars being then drawn against the frame of the door so as to ensure an air-tight joint by longitudinal movement being imparted to the hook-like members. Owing to this arrangement, only a small movement need be imparted to the locking bars, and pressure is exerted on the door without any great force being expended. When the pressure on the door has been removed, the operation of the locking bars can be effected quite easily from one side of the retort opening by means of a lever; "so that there is no danger of the attendant being struck by the charge as it leaves the retort."

To prevent the door being shifted from its frame by the weight of the charge and the locking bars being thus jammed against the holding members after the pressure on the door has been released and thereby rendering it difficult to disengage the locking bars, an auxiliary pressure device is provided on the door whereby the door is still pressed against its frame after the pressure over the main body of the latter has been released.

Manufacturing Incandescent Gas Mantles.

WERBER, I., of Vienna.

No. 21,942; Sept. 25, 1909. Date claimed under International Convention, March 20, 1909.

Heretofore mantles for incandescent gas lighting have, the patentee remarks, been manufactured by drawing together a suitable length of hose at one end, either by hand or by a machine. The first-named method is "troublesome and slow;" and both methods present the defect that "a uniform contraction of the hose for forming what is called the spider is not possible, but folds of different sizes are produced irregularly and form a very thick spider, thereby producing irregularity in the thickness of the finished mantle, resulting in irregular incandescence of the mantle, as the thickened parts are less bright." The present invention has for its object to provide means for manufacturing mantles (more particularly for inverted lighting) by machinery, so that the material of the hose is uniformly distributed towards the spider, and the latter is not thickened.

The process comprises a number of steps. A tubular hose (of a length, or a multiple of the length, of the mantle to be formed) is first of all drawn on to a cylindrical mandrel, whereupon the part projecting beyond the mandrel is drawn in by members of a device acting simultaneously and uniformly from the outside towards the inside, and, if desired, the projecting surplusage is severed. The hose drawn together in this way can then either be tied on the apparatus at its narrowest place or else it can be stitched in a sewing machine for forming a smooth "spider."

APPLICATIONS FOR LETTERS PATENT.

7013.—MONSKI, A., "Gas-blower." March 21.
7018.—MORGAN, J. T., "Mantles." March 21.
7033.—SPARKS, E., "Pressure controllers for gas lighting systems," March 21.
7039.—FERNHOLZ, E., "Inverted lamps." March 21.
7044.—BERNARD, C., "Valves or cocks." March 21.
7086.—TORCHEBEUF, C., and LANNEAU, E. DE, "Incandescent burner." March 21.
7102.—MILLS, E. & A., "Bracket for gas-shade." March 22.
7113.—PREEN, A. H., "Gas-stoves." March 22.
7161.—SPEAR, M. H., "Pipe-joints." March 22.
7178.—BIHELLER, S., "Gas-lamps." March 22.
7249.—SIMPSON, F., and WOODS, A. R. T., "Measuring the flow of liquids in enclosed conduits." March 23.
7344.—WEST, J., "Charging gas-retorts." March 23.
7348.—TRUSCOTT, A. L., "Gas-burners." March 23.
7355.—MASTERS, R., "Charging and discharging gas-retorts." March 24.
7420.—K. & A. WATER-GAS COMPANY, LTD., and SMITH, H. E., "Process for the utilization in water-gas plants of fine breeze and other similar fuel of small grades." March 24.
7441.—SCHIMEK, L., "Inverted lamps." March 24.
7495.—GUEST, A. A., VAN MARLE, M., and GIBBONS, G. B. A., "Charging inclined retorts." March 26.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

On the re-assembling of the House last Thursday after the Easter recess, the Lord Speaker (Lord Denman) announced that the opposition to the Matlock Bath and Scarthin Nick Urban District Council Bill had been withdrawn.

HOUSE OF COMMONS.

The House re-assembled last Tuesday after the Easter recess. On Thursday, the South Hants Water Bill was read a second time and committed; and it was ordered that the Committee should have power to inquire whether the promoters have made adequate provision for the supply of water at reasonable rates to the agricultural community within the area of supply, and to any person or persons from whom any existing or natural supply is, or may be, withdrawn owing to the works or undertakings authorized by the Bill; and, further, to insert such clause or clauses as they think necessary to impose upon the promoters the obligation to provide such supply.

To-day the Select Committee on Standing Orders will have under consideration an application made to the House a short time since by the Cudworth Urban District Council for leave to deposit a petition for a Bill to empower them to erect gas-works. The Council are supplied with gas in bulk by the Barnsley Gas Company; but they are desirous of taking the matter into their own hands. The existing agreement, which was for seven years from January, 1904, is determinable by either party on giving six months' notice, to expire on the 31st of December following the close of the above-named period. It is therefore desirable that the necessary sanction for the Council's scheme should be obtained in the present session.

LITTLE HULTON URBAN DISTRICT COUNCIL BILL.

THE SUPPLY OF COKE-OVEN GAS.

House of Commons Committee.—Wednesday, March 30.

(*Before Sir* FRANCIS LEYLAND-BARRATT, *Chairman*, *Mr.* FLETCHER, *Mr.* GARDNER, *Mr.* GOLDSMITH, *Mr.* HELME, *Mr.* HORNE, *Mr.* MANFIELD, *Mr.* MIDDLEBROOK, *Mr.* CHARLES NICHOLSON, *Sir* W. PRIESTLEY, *Mr.* JOWETT, and *Mr.* ROCH.)

This is a Bill which proposes to empower the Urban District Council of Little Hulton to supply gas and to provide for the transfer to the Council of so much of the gas undertaking of the Salford Corporation as is situate within the urban district of Little Hulton, to confirm an agreement with the Earl of Ellesmere for the supply of coke-oven gas in bulk to the Council, and for other purposes. There was no opposition to the scheme.

Mr. JEEVES, who appeared for the promoters, explained that, with regard to the transfer of the gas-works undertaking of the Salford Corporation, the Bill originally related to the transfer of two undertakings—that of the Salford Corporation and that of the Farnworth and Kearsley Gas Company. The district was supplied by these two concerns. Last year, the Salford Corporation promoted a Bill with regard to their gas-works, in which they asked, among other things, for further capital powers. The application was opposed by certain authorities within the Salford area; and they obtained such terms that the Salford Corporation withdrew the Bill. The Little Hulton Council considered at the time that it was better that they should not continue their opposition, because the Salford Corporation promised that, if they did not oppose, they would deal fairly with them in selling the undertaking to the District Council. The negotiations were afterwards continued between the Corporation and the Council, with the result that the Corporation agreed to sell to the Council the part of their undertaking which was within the Council's limits, for the sum of £7500. When the Bill was deposited, the agreement between the Council and the Salford Corporation had not been completed; and therefore a clause had been inserted in the filled-in Bill. The Salford Corporation wanted it to appear that any arrangement come to with the Council was come to by agreement. In the outside district, the Earl of Ellesmere had extensive coke-ovens from which a vast quantity of gas was produced; and after considerable negotiations, his Lordship agreed with the Council that, if they were able to purchase either the Salford area or the Farnworth area, or both, he might arrange to supply them with gas from his coke-ovens on advantageous terms. The terms were that his Lordship should provide everything necessary, including the gasholders and purifiers. He was to provide the mains from the existing works to the new works, to erect purifiers, the gasholder, and the meter-house; and the District Council were to pay for the gas which passed through the meter according to the amount registered by it. For the gas so supplied, he was to receive 9d. per 1000 cubic feet; so that the Council were getting the gas into the holder for this price. This was a means of utilizing what was really a waste product, because while a certain amount of the gas was required for heating the coke-ovens and for driving engines, &c., there was still a surplus from which his Lordship could supply. The Earl of Ellesmere was not anxious to make any large profit out of the district; and he agreed this figure in respect of which he was not only to let the Council have the waste product, but he had to put up works which would cost him some £5000. It was an economical and favourable arrangement for the District Council; and in order to provide against the possibility of a strike with regard to the colliery in connection with which the existing works had been erected, there had also to be put up the necessary

plant to enable the gas to be produced, if found desirable on the site of the new works. This, again, was to be put up by his Lordship; so that in case of need it could be used for the purpose of fulfilling his agreement. There was a proviso that if the agreement was put an end to—as it might be after 35 years—the Council were to have the right to purchase the new works at their then structural value; and this was the reason why the Council desired to purchase the part of the Salford undertaking which was within their district. After making very liberal estimates for all the cost the Council would incur, it was expected that the sum of 5d. or 6d. per 1000 cubic feet would be saved. This saving would be effected during the time in which the capital cost had to be repaid; and the interest in respect of the capital had also to be paid. So that during the loan period there would be a saving in the price of gas of 4½d. or 5d., and probably 1d. more; and at the end of this period, the price at which they would be able to supply would be considerably reduced. Replying to a question by the Chairman, Counsel stated that the Council had arranged with Lord Ellesmere that he would give them the supply for both the Salford and Farnworth areas, and the Council had hoped to make arrangements with the Farnworth Company to enable them to purchase either on a price agreed when they came before the Committee or on arbitration terms; but the Farnworth Company were wholly opposed to it. It was therefore left over in the hope that, later on, they might be able to make some arrangement. There was some question as to whether the Council were within the statutory limits of the Salford gas supply; but so far as he had been able to follow the Salford Acts, the area was not within their statutory limits, although the Salford Corporation had for many years been supplying there. It was a question of the boundaries of old parishes. An undertaking had been entered into that they would give such a supply of gas as might be required during the 35 years, and in fact they would be able to supply a district many times this size.

Mr. *J. H. Heyes*, the Clerk to the Council, said a resolution for promoting the Bill was rejected at a meeting of the electors; one of the grounds for the rejection being that it would interfere with the local mining industry, as one of the local collieries supplied the Salford Corporation with coal for making gas.

Mr. *E. Bury*, the Manager of the Brackley Coke-Works, which are situated some 200 yards from the Little Hulton boundary, said these works consisted of fifty bye-product coke-ovens. These ovens were supplied with hydraulic mains similar to those used at gas-works, with condensers for cooling the gases and for removing the tar and liquor, precisely similar to those used in gas-works, and also with tar-fog removers, exhausters, and scrubbers. After passing through the plant, the gas was sent forward to the flues surrounding the coking-chamber. Two-thirds of the total gas made was utilized in this way; and the remaining one-third went under the boilers for raising steam. The amount of coal carbonized per day was 220 tons on an average; and the make of gas per ton (being a very good gas coal) was about 10,000 cubic feet—amounting to a make of 2,200,000 cubic feet. Of this quantity, about one-third (700,000 cubic feet) was used for the boilers. It was part of this which wou'd be available for lighting the district. The present requirements of Little Hulton were 13 million cubic feet per year, or about 37,000 cubic feet per day for the Salford area. The plant had been duplicated and arranged in such a manner that practically there was no chance of suspension of the process for more than an hour or two. The hydraulic mains had been built in sections. The ordinary method of constructing coke-oven plant was to build it with one hydraulic main per battery, so that the gas in the whole of the ovens went into one hydraulic main. There were two batteries of coke-ovens. They had provided hydraulic mains cut in halves; so that, in the event of a breakdown at any one point, a portion of the coke-ovens could be worked which otherwise would have to be shut down. With regard to machinery, they had two rams—one electric and one steam. The electric ram was the one generally used; but in the event of a breakdown to a motor, the steam-ram could be put into operation at once. Spare armatures were kept for putting in the motor of the electric ram; so that it was impossible for a long breakdown or stoppage of the carbonizing plant to take place from this cause. There were three exhausters, any one of which was capable of doing the whole of the exhausting for the entire plant. There were two duplicate sets of high-speed steam-engine electric generating sets, which were run in turn—one working and the other at rest; and spare armatures were kept in the event of a breakdown of the generating plant. With respect to the washing plant, there was a duplicate motor in the event of the main driving motor breaking down; and in the event of any breakdown to the washing plant itself, they could bye-pass raw coal into the storage bunker which supplied the ovens. It was quite a modern process, which had run very satisfactorily with them for eleven years. The gas at Brackley was approximately equal in quality, with regard to its analysis, calorific value, and illuminating power, to that supplied by the Metropolitan Gas Companies; so that they had taken the average illuminating power of 16 candles, tested by the No. 2 "Metropolitan" argand. Its calorific value was 575 B.Th.U. Witness handed to the Committee a copy of the "JOURNAL OF GAS LIGHTING" showing the result of a large number of tests, compared with the tabulated statement for the metropolitan gas. For the purpose of their coke-ovens first-class gas coal was used; and they would be able to supply gas of a uniform quality. In the agreement, provision was made that if the District Council required the candle power to be increased above 14, they should enrich the gas at the price of ½d. per candle power; but there was no likelihood of its being necessary to enrich. The average would be 16 candles; but they were under obligation to supply 14-candle power gas for 9d. per 1000 cubic feet. It was not likely that the gas produced would be under 14 candles; but if it did happen, there would be no difficulty in enriching it. They entered into a binding agreement to supply gas of 550 B.Th.U. without extra cost; and, supplying it of the calorific value, they necessarily must supply the candle power. If the District Council required a 20-candle power gas, they could have it by paying ½d. for each candle.

In reply to Mr. ROCH, witness said that further capital outlay would be necessary at Brackley in order to supply the additional gas. This would be roughly £5000. The annual income from the sale of the gas would be 13 million cubic feet at 9d., which worked out at £487 a year gross. The agreement was for 35 years.

Mr. HORNE: And you are to spend £5000 for the purpose of making £500 a year?

Witness: Yes; but something will have to come off that—the working cost and, of coursé, depreciation of plant, and so on. This is only the gross sales.

Mr. *Jesse Wallwork*, Lord Ellesmere's Mining Agent, said the output of coal from the collieries was about a million tons a year. The seams from which the coal was obtained for making the coke would probably last another fifty or sixty years. With regard to the question of a strike, at the coke-works, they were on a sliding-scale agreement with the men, which had worked very satisfactorily for several years, and there had been no stoppages.

Mr. MIDDLEBROOK: Do you consider that, with an income possibly as low as £300 a year and a probability of £500 a year, this is a sound scheme for the expenditure of a capital of £5000?

Witness: We have carefully considered it. Lord Ellesmere is a very large ratepayer, and any reduction in the rates his Lordship would benefit from. I do not expect that from the present supply his Lordship would make more than £150 a year from the scheme. There are, however, large areas adjoining which might come in later; and we should be able to supply them if they did. We are not pressing the scheme by any means.

Asked whether the gas was really a waste product, witness said it was to some extent; but they used it in the boilers for raising steam.

Mr. *William Newbigging* said the Salford gas agreement was that for the sum of £7500 the District Council were to purchase the Salford undertaking within a particular area. The price charged for gas in Salford was 2s. 4d. per 1000 cubic feet; but in the Little Hulton area it was 2s. 7d. The profit which Salford had made out of the supply of the Little Hulton area was 10d. per 1000 cubic feet on the consumption; so that the cost was 2s. 7d. less 10d. This worked out at £544; and he had applied the multiplier of 22 years and arrived at the figure of £11,968. The Salford Corporation were not handing over any gas manufacturing plant; simply the distributing plant. From £11,968 he had deducted £4128, which represented the structural value of the manufacturing plant which Salford retained. The actual figure agreed on was £7500. This came to about 14 years' purchase so far as the distributing plant was concerned—it was 22 years' purchase, including the works. They would be entirely dependent upon Lord Ellesmere's coke-oven supply. In the £7500 goodwill was represented by some £2000. The ground had been opened up, and the mains were found to be in practically as good a condition as when they were laid down. The promoters were not paying the Salford Corporation anything for severance, nor anything for prospective value. The district which they were taking over from the Salford Corporation was 7 or 8 miles from the Corporation works. There was a considerable deposit of the light-giving hydrocarbons of the gas on the way; the consequence being that it reached Little Hulton in a more or less depreciated condition. In the agreement between the Council and Lord Ellesmere, there was a definite obligation on the Earl's part to supply all the gas the District Council might require, and an equally definite obligation on the part of the District Council to take the gas. The price to be paid by the Council to Lord Ellesmere was 9d. per 1000 cubic feet up to 400,000 cubic feet in twenty-four hours; but if the amount were to exceed that, the price was to be reduced to 7d. He was satisfied that, so long as the gas supplied was of 550 B.Th.U., the illuminating power would not fall below 14 candles tested with the "Metropolitan" No. 2 burner. If Lord Ellesmere so desired, he was to be at liberty to supply other local authorities.

The CHAIRMAN said that, before the Committee finally settled the terms of the schedule, if they granted it, they would require to be satisfied that it did not give Lord Ellesmere in any way any statutory authority except to supply this one Local Authority.

Witness said he was of opinion that the Council could supply gas at a cost, exclusive of interest and sinking fund charges, of 1s. 6½d. per 1000 cubic feet. Having made ample estimates, he said they would be able to supply gas at 2s. 2d., as against the 2s. 7d. which was now paid. He thought the gas-mains would be quite as good in 35 years' time as they were now. Recently he took up a pipe that was laid down in 1852, and found it in most excellent condition. He considered that 9d. was a fair price to the Council. In order to earn this, it would cost Lord Ellesmere fully £5000 under the arrangement. He was satisfied the quality of the gas would not suffer. The gas would be registered in the station meter after leaving the gasholder.

The CHAIRMAN pointed out that they were asking sanction to spend £7500, which was not shown on the face of the Bill, and, if something were to turn up, they would be able to go behind the agreement which had not been scheduled. In addition, it would mean a precedent which the Committee did not wish to establish.

After some discussion on the point, the room was cleared, and the Committee considered the matter privately. Ultimately,

The CHAIRMAN announced that the Committee were in favour of the purchase of the gas undertaking, and considered the preamble proved with regard to that. As to the agreement, the Committee felt that it should be scheduled to the Bill; but they adjourned the proceedings till the following day to give the promoters an opportunity of considering the matter.

Thursday, March 31.

When the Committee met this morning,

Mr. CRIPPS, on behalf of the Salford Corporation, on the question of scheduling the agreement between the Corporation and the District Council to the Bill, said that the Corporation had some objection to the precise terms of the agreement appearing on the face of the Bill.

The CHAIRMAN remarked that the important point was that the price of £7500 should go in the Bill.

After a short discussion, the Committee unanimously decided that the agreement should be attached to the schedule.

The Committee then proceeded to discuss the various clauses with regard to general provisions; but in view of the decision that the agreement with the Salford Corporation should be scheduled to the Bill, thereby necessitating the alteration of certain of the clauses, it was decided that Part II., relating to gas matters, should stand over till to-morrow (Wednesday).

MISCELLANEOUS NEWS.

ALLIANCE AND DUBLIN CONSUMERS' GAS COMPANY.

The Half-Yearly Meeting of the Company was held last Thursday, at the Offices, D'Olier Street, Dublin—Mr. W. F. COTTON, J.P., in the chair.

The SECRETARY (Mr. Francis T. Cotton) read the notice convening the meeting and the report of the Directors, which stated that the gross revenue amounted to £165,336, and the expenditure, including interest on loan capital, &c., to £128,364; leaving a balance of profit of £36,972. In accordance with the Company's Act of Parliament of last year, the share capital had been amalgamated and converted into consolidated ordinary stock, upon which the Directors recommended the payment of a dividend at the rate of 5 per cent. per annum, after which a balance of £438 would remain to be carried to the next account. This dividend was equivalent to 10 per cent. and 7 per cent. as formerly paid on the share capital.

The CHAIRMAN, in moving the adoption of the report and accounts, said that the working of the Company for the half year might be considered satisfactory. After providing for payment of interest on the debenture stock, and on overdrafts at the bankers, the Directors were able to recommend the payment of a dividend out of profits at the rate of 5 per cent. per annum on the consolidated stock—being equal to 10 and 7 per cent. on the respective shares as they stood in the Company's books up to Dec. 31 last, before they were converted into stock—whereas, in the corresponding period of last year, it was found necessary to draw upon the reserve fund to the extent of nearly £10,000 in order to pay similar dividends. During the half year under review, there had been expended under the head of capital account £16,961, of which £8911 was spent in parliamentary costs on their new Act. This sum included a charge at the rate of 5s. per cent. stamp duty on the conversion of the share capital into stock. Turning to the revenue account, there had been an increase of £2237 in gas and meter rental; and under the head of products (which included coke, breeze, tar, sulphate of ammonia, and ammoniacal liquor), £2387. There was a saving in expenditure on coal and oil of £4272—a total saving of £11,376. Compared with the corresponding period of last year, there was an increase of about 1 per cent. in the sale of gas. This was a very small increase, having regard to the cold and severe winter experienced since early in October last. However, it would seem that they were now getting over the drawback in the sale consequent on the introduction of incandescent burners and electric light. He thought they might anticipate that, in the near future, they would have a normal increase in the sale of gas from new customers, as heretofore. During the half year, they had obtained 1878 new consumers. Of these, there had been 1564 new automatic installations, in each case fitted with cooker, brackets, and pendant. The provisions of the Company's Act passed in the last session came into operation at the beginning of the year. Some consumers were put to inconvenience by reason of not having applied to the Company to have the burners changed for those authorized by the Act, though notice was advertised on several occasions in the Press that the Company were bound to supply and fit, free of charge to the consumers, new and suitable burners. As regarded the incandescent burners, they would require re-adjusting; and, as in the case of ordinary burners, the Company would have them attended to free of cost to the customers. During the passing of the Bill, there were conditions proposed by the Corporation to which the Directors, after due consideration, assented. One of these was in connection with the selling price of gas within the City of Dublin. It guaranteed that, for a period of three years, commencing January, 1910, the price should not exceed 3s. 4d. per 1000 cubic feet, provided there was no considerable rise in the price of coal. He had on a previous occasion referred to the new retort-house being erected, with all modern appliances for the economical production of gas, in the Brunswick Street station. One section of this house was completed during the half year; and, so far as present experience went, the results were most satisfactory.

The report was adopted, and the dividend recommended was declared.

Mr. MAGUIRE, in moving a vote of thanks to the Chairman, Directors, and staff, said they had to compete with an undertaking which was subsidized out of the rates, to which rates the Gas Company had to contribute a large sum—£11,000 or £12,000. This showed the evils of municipal trading.

The CHAIRMAN, in acknowledging the vote, said he understood that the total loss to the rates on the electric lighting was, up to the present, about £50,000. Even the poorest ratepayer, in a district where there was perhaps no electric light at all, had to pay his share of this loss.

The SECRETARY returned thanks on behalf of the officials.

SAN PAULO GAS COMPANY, LIMITED.

An Increased Dividend.

The Annual General Meeting of the Company was held on the 23rd ult., at the Great Eastern Hotel, Bishopsgate Street, E.C.—Mr. D. M. Fox in the chair.

The SECRETARY (Mr. G. H. Rogers) read the notice convening the meeting; and the Directors' report (noticed in the "JOURNAL" for March 22, p. 815) and the statement of accounts were taken as read.

The CHAIRMAN, on rising, said he had again the pleasure of congratulating the shareholders on the highly satisfactory report and accounts submitted for their approval. The results for the past year showed that the Company's business had continued to make satisfactory progress; but during the period under review, nothing eventful or exceptional had happened. There had been no "boom" in either the export or import trade of the State, but just the steady normal development of the City of San Paulo. Business during the year had been generally good, and the exchange had been practically stationary throughout the twelve months at an average of about 15⅛d. The Company's prosperity had simply kept pace with the steady advancement of the City and State of San Paulo. He thought they might regard it as the most satisfactory and encouraging feature of their position that their increasing prosperity was proportionate to, and dependent upon, the continuous development of the city itself; and he ventured to predict that, as the City of San Paulo expanded as a commercial, industrial, and residential centre—as it undoubtedly would do—so would the business and prosperity of the Company go on increasing year by year. At the same time, he thought that he might justly claim that their progress of late years had been largely attributable to the liberal policy of the Directors, ably seconded as it was by the management in San Paulo, of improving the standard of the public and private lighting, and of lowering the price of gas, especially for the purposes of cooking and heating—at the same time affording every facility to the customers in the matter of the supply of house-fittings and other materials at low rates, thus popularizing the use of gas. This policy had been amply justified by results, in the face of the inevitable competition from electricity. This popularizing of the use of gas seemed, however, to have a tendency to cause the consumption per consumer to decrease—as was proved by the fact that, though the number of consumers during the past year increased by 14 per cent., the Company only obtained an increase of 10 per cent. in the sales of gas. This would seem to indicate that in San Paulo gas might be termed the "people's light." It was gratifying, however, to record that the advantages of gas for heating and cooking purposes were being more and more recognized among the better-to-do inhabitants. The gross receipts for the past year amounted to £179,180, which was an increase of £9628, or 5 per cent. The working expenses, including London charges, &c., were £134,501, which was an increase of £5820, or some 4 per cent. The profit was £44,679, which was an increase of £3808, or 9 per cent. As was stated in the report, to this balance of profit had to be added dividends on investments £838, and the sum of £6432 brought forward from 1908—making altogether £51,959. Out of this, provision had been made for service of debentures, the dividend on the preference shares, and other items requiring the sum of £20,398, and leaving a disposable balance of £31,561. The Board had placed £5000 to the reserve fund and £5000 towards renewals to be carried out during the current year; and they recommended the payment of a final dividend of 6 per cent. on the ordinary shares, tax free, making 9 per cent. for the year, and leaving the sum of £6561 to be carried forward to the next year's accounts. This increase of dividend on the ordinary shares would doubtless meet with the approval of the shareholders; and he would like to emphasize the fact that the Board would not have recommended such an increase had they not good reason to believe that in the future this rate would be permanently maintained. It was not his purpose to recapitulate and comment in detail upon the various items of the balance-sheet and revenue account. The figures spoke for themselves, and were evidence of the sound financial position of the undertaking. The following points might, however, be interesting. The receipts from sales of gas increased by £12,189, or about 10 per cent. As to residuals, though the quantity of coke sold was about the same as the previous year, the receipts were less by £3092; the falling-off being due to the Company having been obliged to reduce prices and afford facilities in consequence of the successful competition of electricity for power. Tar was in better demand; and an improving market was being found for pitch, refined tar, and other products. The lower price of coal prevailing last year had helped to keep down the principal item of expenditure; and improved carbonizing resulted in a higher yield of gas per ton of coal carbonized. Under the heading of repairs and maintenance, extensive alterations in progress were mainly responsible for increased charges. The work in hand, when completed, would greatly relieve the congested state of the works, and facilitate the more economical handling of coal and coke in addition to materially increasing the coal storage capacity. The distribution expenses had increased by £2500; but it must be borne in mind that the Company served a large area in proportion to the number of consumers; and the proper upkeep of the plant was of vital importance. The cost of maintaining the public lamps had increased in proportion to the number of lamps added during the year. The number of public lamps in use at the end of the year was 5818, or an increase of 598 for the twelve months; and the Company had orders for about 300 more. The replacement of lanterns of the old and unsightly type was urgently desirable, and during the current year would be accelerated. The lighting in general, he might remark, had continued to give satisfaction. The additional expenditure on capital account amounted to £22,328, of which new mains £12,491, new lamps £3812, and meters £3420 were the principal items. It would be noticed that real estate in San Paulo now amounted to nearly £20,000; a sum of £10,374 having been expended during the year on the purchase of premises to serve as the permanent headquarters of the Company in San Paulo. The necessity for this acquisition was primarily brought about by the State Government having required possession of the building formerly occupied by the Company (which adjoined the Palace and Government Offices) for the Public Service. An agreement was accordingly entered into by which the present premises were let to the State Government on advantageous terms; and the Company purchased commodious premises in the same street which, at a comparatively small cost, had been transformed into admirable central offices and city show-rooms and residence for the Manager. It would be impossible to find a more suitable situation; and a saving of an annual rent of £750 would be effected, as the Company would no longer require a shop that had been for some years rented for show-room purposes. A new house had also been built for the residence of the Company's Engineer, at a cost of about £2000. His former residence in the works was inconvenient, and interfered with the carrying out of necessary works improvements, and it was now being demolished. The tramway connecting the works with the depôt of the San Paulo Railway had been relaid with grooved rails. The locomotive and waggons had arrived, and shortly the new system of traction would be inaugurated—within the time specified in the agreement with the Camara Municipal. The Company continued to be on the best of terms with the authorities

of the State Government and the Camara Municipal. In view of the report, and of what he had stated, shareholders would not be surprised to hear that the Directors proposed in April or May to make a further issue of about £57,500 of the 6 per cent. preference shares. This would make the issue of the preference shares £120,000, instead of £62,500 as at present. He was sure shareholders would have noticed with regret that their old and valued Manager and representative in San Paulo was retiring, after ten years of faithful and valuable service. But this regret would, he was convinced, be mitigated by the knowledge that they were still to have the advantage of his assistance on the Board. It would be difficult to overrate the services rendered to the Company by Mr. Gray—rendered at times under great difficulties; and he retired from active service with the esteem and good wishes, not only of his brother officers and employees, but of the President and officials of the Government of the State and of the Camara Municipal, as well as of the inhabitants of the city, among whom he lived and worked. The shareholders would be pleased to know that his retirement had been foreseen, and steps had been taken by the Directors to provide a substitute. Mr. Biddell had been trained for some time past to assume the post of representative; and the Board were satisfied as to his capacity to fill this important position. Mr. Whyte—their capable and well-tried servant—continued to be the Engineer; and the Board hoped the two would work together loyally in the Company's service. If he might conclude on a personal note, the shareholders would have noticed perhaps that this was the fortieth annual general meeting. It reminded him that he was instrumental in obtaining the original concession in the sixties; and for two years after the formation of the Company he acted as local Director in San Paulo. It was interesting, as demonstrating the enormous increase in the importance of the City of San Paulo, to note that the increase only in the number of lamps during the past year was 600—being 100 more than the total number of lamps specified in the original concession. It had been one of the pleasures of his life to have contributed, in so far as he was able, to the prosperity of so successful an undertaking. He begged to move the adoption of the report and accounts.

Mr. A. F. PHILLIPS seconded the motion.

Mr. E. CLARK said it was a pleasure to be able to attend the meeting and congratulate the Board on the high pitch of prosperity to which they had brought the undertaking. He would be glad to know how much gas per ton of coal carbonized was actually sold for lighting or for other purposes; for this was the great test as to whether or not a gas company was being successfully administered. Electrical people were very fond of showing the uses to which their own commodity could be put, and he felt sure that in the new premises which the Company had acquired the Directors would take care to make clear the reasons why people should adhere to gas, and demonstrate the fact that gas could be successfully utilized for all purposes. One or two South American companies owed their present prosperity, not to the development of gas for lighting purposes, but for heating.

Mr. PHILLIPS replied that the make of gas was about 11,400 cubic feet per ton; and the quantity brought into charge was a little over 10,000 feet. Perhaps the shareholders might consider that the difference was a large one; but he might remind them that a very considerable portion of the gas in San Paulo was sold for public lighting, and the Directors preferred to treat the lamps, in the matter of consumption, in an extremely liberal way. Rapid development was taking place in the use of gas for cooking and heating; the consumption last year for these purposes having been 28 per cent. of the total output of the Company.

The resolution was then carried unanimously.

On the motion of the CHAIRMAN, seconded by Major H. N. WEBB, a dividend was declared on the preference shares at the rate of 6 per cent. per annum, less tax; and a further dividend on the ordinary shares of 6 per cent., free of tax, making, with the interim dividend, 9 per cent. for the year.

The retiring Directors (Mr. John Barker and Major Webb) and the Auditors (Messrs. Cash, Stone, and Co.) were subsequently re-elected.

An Extraordinary Meeting.

The CHAIRMAN remarked that they had now to hold an extraordinary meeting for the purpose of passing the following resolution:—"That the remuneration of the Directors be increased by the sum of £300 per annum, and that the Directors' and Auditors' fees be free of income-tax, in the same manner as the dividends on the ordinary shares." The shareholders had, he said, heard how the Directors proposed to strengthen the Board by the election to it of Mr. Richard Gray on his return to England from San Paulo.

Mr. BARREYMAN moved the resolution, and expressed his pleasure that Mr. Gray was going to join the Board.

Mr. CLARK inquired what the Directors' fees were at present.

The CHAIRMAN: £1250.

Mr. LONGBOTHAM then seconded the proposition, and it was unanimously carried.

A cordial vote of thanks to the Chairman and Directors having been passed, on the motion of Mr. CLARK,

The CHAIRMAN acknowledged the compliment, and afterwards, in reply to a shareholder, said it was proposed to issue the new preference shares *pro ratâ* to the ordinary and preference shareholders. Of course, they would not offer them to debenture holders; but a holder of preference shares was as much a shareholder as was the holder of ordinary ones. They were legally advised that if they offered them to the shareholders *pro ratâ*, they must include all shareholders.

WANDSWORTH AND PUTNEY GAS COMPANY.

Ten Years' Record Progress—Profit-Sharing to be Introduced.

On the occasion of the annual winter dinner of the employees of the Wandsworth and Putney Gas Company, which was held recently in the Wandsworth Town Hall, under the presidency of Mr. H. O. Carr, the Company's Engineer, the toast of the evening—"Prosperity to the Company"—afforded the Chairman, as at previous similar gatherings, an opportunity of bringing before those present some interesting particulars in regard to the undertaking in which they are engaged, and in the prosperity of which they are largely concerned. Mr. Carr said there was no doubt about their prosperity, for during the six months ended Dec. 31 last they had been pacing along with an increase of 6 per cent. in the quantity of gas consumed. They continued to supply the cheapest gas in London—a fact in which they took great pride, especially as the price had recently been reduced to 1s. 10d. per 1000 cubic feet. The prosperity of the Company and the cheapness of the gas were brought about by careful management through all ranks. First of all, they had an eminent and worthy Chairman in Mr. H. E. Jones, who was, he thought, unapproached by any other gas engineer or gas expert in the country. The Directors were mostly local gentlemen, and, of course, knew a great deal about the neighbourhood, which was an excellent thing; while the staff and workmen did their best to support the Board. He should like to draw a few comparisons between what they were doing to-day and ten years ago. In 1900, they were selling about 650 million cubic feet of gas a year; whereas now they were selling considerably more than 1000 millions. The number of consumers had grown from 12,000 to 28,000. Of late years they had made large reductions for gas for any power that was required for industrial purposes in the district; and it was interesting to note that ten years ago there was not, he believed, more than 1 cubic foot in every 100 feet used for power. To-day there were upwards of 5 cubic feet out of every 100 feet consumed for industrial and trade purposes. Just to show what a difference lighting by mantle instead of by the old flat-flame burner had made for the Company, he would remark that ten years ago the public lights which were for the most part, if not all, fitted with flat-flame burners, used 6 cubic feet in every 100 feet produced; whereas now, with mantles and a great many more lights, only 4 cubic feet in every 100 feet were used for public lighting, notwithstanding that each lamp was six or seven times as brilliant. Then they came to the most interesting of all comparisons—viz., with regard to cooking and heating. Ten years ago there were only 40 cubic feet in every 100 feet used for these purposes; and now there were more than 60 feet. Gas cooking and heating stoves went a long way to solve the domestic servant problem. The figures he had extracted only left one other item, and that was for private lighting in houses, which also was affected by mantles having superseded flat-flame burners. Ten years ago, 53 cubic feet in every 100 feet were used for private lighting; but now only about 30 feet were so employed. This showed the great change which had been effected by incandescent mantles. But he did not deprecate their use. On the contrary, the incandescent mantle had been the means of reserving the bulk of the lighting to gas companies. Some time ago, in gathering other information, they ascertained how many flat-flame burners were left in their district; and they were rather surprised to find that nearly one-half the number were of the old type. But most of these burners were in unused parts of the houses. The price of gas about ten years ago rose to 2s. 6d. per 1000 cubic feet; and now it had fallen to 1s. 10d.—a difference of 8d. This meant that it had fallen, on an average, nearly 1d. a year. If it continued to go down at this rate, in 22 years or thereabouts the public would be getting gas for nothing. This was very improbable; but at any rate they were going to try to get as near it as possible. There was one claim they could make in common with other gas companies, and that was in the clarification of the atmosphere. This winter there had been no fog; and he found from statistics which had been published that in 1905 there were 44 fogs, in 1906, 19; in 1907, 24; in 1908, 13; in 1909, 4; while in 1910 they might say that the fogs had been missed. The Wandsworth and Putney Gas Company did not lack in the matter of enterprise. They were soon going to open what would be a very fine show-room in Putney High Street, where they hoped to do a great deal of business. They would show there the latest examples of lighting and heating, and how gas might be used most effectively for cleansing and cooking. The Borough Council recently paid the Company a great compliment by stipulating in their contracts for "Wandsworth" coke, which was their own special production. The lowering of the price of gas meant a reduction in the cost of public lighting; and the more the Borough Council could reciprocate with the kindly feeling that they had lately shown, the better it would be, he was sure, in the course of years, for the price of gas.

The toast was responded to by Mr. C. W. Braine, the Secretary of the Company. He said he was certain that all did their best to further the interests of the Company; and if they were to keep the price of gas as low as it was at present, they must all pull together as one. There was nothing like honest work; and if everybody gave his best, he would have a feeling of satisfaction in having done his duty, as well as in knowing that he had contributed towards the prosperity of the Company. He had no doubt those present had read the remarks of the Chairman of the Company, at the last half-yearly meeting, with regard to the proposed scheme of profit-sharing. They had examined schemes of this description adopted by other companies, and in a few weeks the employees would hear an explanation of the scheme, which he thought they would not consider a bad one. It would, at any rate, make everyone feel that he had an interest in the Company besides being an employee.

GAS PROFITS AND RATE RELIEF AT BURTON-ON-TRENT.

Protest by the Chairman of the Gas Committee.

A Special Meeting of the Burton-on-Trent Town Council was held a few days since for the purpose of making the new rate for the current financial year. The MAYOR (Mr. T. Jenkins) presided.

Alderman COXON, the Chairman of the Finance Committee, in moving the adoption of the new rate, made an exhaustive statement in regard to the financial position of the town, and pointed out that the Council were indebted, as usual, to the Gas Committee for their generous support towards the rates, as the Finance Committee had anticipated a grant from them of £7000, as last year.

Alderman LOWE, the Chairman of the Gas Committee, protested against this proceeding; saying that the sum named had been put down without consulting his Committee in any way whatever. He

reminded the Council of the history of the contribution that the Committee had made for years past. Some time ago, the Council gradually acquired the opinion that the financial resources of the Committee were inexhaustible; and the contributions gradually increased, and their working capital almost entirely disappeared. The time came when it was necessary to make a stand; and the whole Council agreed unanimously that £5000 was a fair sum for the gas undertaking to contribute towards the rates, and also a fair one between the consumer and the ratepayer. This was adhered to for two years. But about four years ago the then Chairman of the Finance Committee said they would have to ask for £6500, or the rates would have to go up. This went on for four years; and at the end of last year Alderman Coxon said he not only could not reduce the amount, but must ask for £500 more. The Gas Committee gave way on the understanding that as soon as the then pending financial adjustment with the County Council was settled, they should go back to their normal figure of £5000. Now £7000 had been voted by the Finance Committee. He felt very much disposed to propose an amendment that the rates be reduced 1d. less; but he was informed that such a step would throw their finances in such chaos as prevailed in other parts of the country. He did not, therefore, propose taking such a step; but he hoped that between now and next year the Council would pass a resolution which would make it impossible for the Finance Committee to vote sums without consulting committees first. It was absurd business that they should not have an opportunity of dealing with their own finances first. The Finance Committee would never again have such an opportunity of putting things right. The Gas Committee desired to make a regular contribution to the rates of the town; but they also wished to reduce the price of gas when they were able to do so. If, however, they continued this high contribution, it was impossible for them to do this. He intended to make this emphatic protest against a procedure which was a very unwise one, and which he was sorry that the Finance Committee had adopted.

Mr. HUTCHINSON said he had never heard Alderman Lowe make a speech on the gas question with which he was so absolutely in harmony. If there was one thing that was mentioned at public meetings it was that consumers should have their gas at a reasonable figure. Here they had an opportunity. The public had been led to expect a reduction of not more than 3d. in the pound; and the Borough Treasurer had estimated 4d., while 5d. was only agreed upon after a division. Several of them felt that it was not advisable to bring the rate down to the lowest possible limit. The public only expected 3d., and would have been content with this reduction. The gas consumers had reason to complain that an opportunity of reducing the price of gas had not been taken advantage of.

Mr. KING said he asked in the Finance Committee if the Gas Committee had been consulted in this matter; and the answer was that they made no objection. Alderman Lowe had known long enough that silence gave consent; and so they took it that his Committee had decided to allow the same as last year. He thought they could afford to do it; and no doubt the ratepayers would be able to appreciate the very satisfactory reduction in the rate.

Mr. WARDLE said he had a good deal of sympathy with Alderman Lowe. He was a member of the Finance Committee, and approved of the £7000; but he was strongly against any more than this being taken, for any advantage obtained by increased consumption should be used for the benefit of the consumers.

Alderman ROWLAND said he wished to disclaim any desire on the part of the Finance Committee to ignore the Gas Committee, or to show them any discourtesy. In face of the strong protest that had been made, he was compelled to uphold the Finance Committee. He thought the Chairman of the Gas Committee was a little to blame, for he had had the estimates before him, and knew that the next step was the calculating of the rate. With this full knowledge, Alderman Lowe made no representation to the Finance Committee; and in its absence, they did the same as before. For himself, he agreed with Alderman Lowe's principle; and it was a matter which could easily be adjusted in future. At the same time, as an outsider, he was sorry to hear any suggestion that a reduction should be made from £7000. The only argument that appealed to him against taking this amount was the possible increase in the price of coal; but against this they had to remember that there was the new gasholder and the first set of new retorts, so that there would be corresponding economies. In conclusion, he submitted that the time to make an alteration in the price of gas was when the reorganization of the works was completed.

Alderman COXON, in reply, acknowledged that the Finance Committee did, in the matter in question, take "French leave" to some extent; but he explained that there were upon the Committee two members of the Gas Committee, who thought their finances would stand the taking of the £7000. His Committee consequently went on.

The proposal was sanctioned.

HULL CORPORATION WATER SUPPLY.

Thirteenth Annual Report.

The Water and Gas Engineer of the Hull Corporation (Mr. C. B. Newton, M.Inst.C.E.) has lately issued the thirteenth annual report on the water supply of the city. It shows that the total quantity of water drawn from the wells last year was 3,884,742,000 gallons—being 1,871,764,000 gallons from Springhead and 2,012,978,000 gallons from Cottingham. The greatest quantity sent out from each pumping-station in one day was Springhead, 8,849,000 gallons, on Dec. 28; and Cottingham, 11,189,000 gallons on Dec. 17. The total quantity of water pumped was 28·3 million gallons more than in 1908. The supply per head per day within the water limits was 37·52 gallons; through meters, 9·94 gallons; and for domestic and unmetered trade purposes, 29 gallons. The covered service reservoir at Keldgate, which was practically completed at Christmas, 1908, was brought into use on the 30th of June last; the opening ceremony being performed by the Mayoress, Mrs. H. Feldman. The reservoir was named (after the place in which it is situated) by Mrs. Hargreaves, the wife of the Deputy-Chairman of the Water and Gas Committee. The area of the district within which the Corporation are authorized to supply water is the same as before—viz., 16,377 acres, or 25·59 square miles. In addition, they sell water in bulk to the Cottingham Urban District Council for the district of Cottingham, and to the Sculcoates Rural District Council for the Sutton and Preston districts. The estimated average population

GAS COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 19.

Issue	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
1,474,000	Stk.	Apl. 1	5	Alliance & Dublin Ord.	84–86*	+½	5 16 3
310,000	Stk.	Jan. 13	4	Do. 4 p.c. Deb.	98–100	..	4 0 0
200,000	5	Oct. 28	7½	Bombay, Ltd.,	6⅞–7⅛	..	5 5 8
40,000	5	,,	5½	Do. New, £4 paid	5–5¼	..	5 6 8
50,000	10	Feb. 25	15	Bourne- 10 p.c.	29–30	..	5 0 0
311,810	10		7	mouth Gas) B 7 p.c.	16¼–16⅝	..	4 3 7
75,000	10	,,	6	and Water) Pref. 6 p.c.	15–15½	..	3 17 5
380,000	Stk.	,,	12½	Brentford Consolidated	250–253	..	4 18 10
300,000	,,	,,	9½	Do. New	187–189	..	5 0 6
50,000	,,	Aug. 12	5	Do. 5 p.c. Pref.	120–122	..	4 2 0
206,250	,,	Dec. 29	4	Do. 4 p.c. Deb.	101–103	..	3 17 8
220,000	Stk.	Mar. 16	11	Brighton & Hove Orig.	213–216	..	5 1 10
246,320	,,	,,	8	Do. A Ord. Stk.	152–155	+1	5 3 3
460,000	22	Apl. 1	10⅝	British	44–45*	..	4 14 8
109,000	Stk.	Feb. 25	6	Bromley, A 5 p.c.	116–118	..	5 1 8
168,700	,,	,,	4½	Do. B 3½ p.c.	87–89	..	5 1 2
82,378	,,	,,	5⅛	Do. C 5 p.c.	104–106	+1	5 3 9
55,000	,,	Dec. 29	3½	Do. 3½ p.c. Deb.	87–89	..	3 18 8
500,000	10	Oct. 14	7	Buenos Ayres (New) Ltd.	—	..	—
250,000	Stk.	Dec. 29	4	Do. 4 p.c. Deb.	98–100	..	4 0 0
100,000	10	—	—	Cape Town & Dis., Ltd.	4–5	..	—
100,000	10	—	—	Do. 4½ p.c. Pref.	6–7	..	—
50,000	50	Nov. 2	6	Do. 6 p.c. 1st Mort.	49–50	..	6 0 0
100,000	Stk.	Dec. 29	4½	Do. 4½ p.c. Deb. Stk.	86–88	..	5 2 3
157,150	Stk.	Feb. 25	5	Chester 5 p.c. Ord.	105–108	..	4 12 7
1,513,280	Stk.	Feb. 25	5⅛	Commercial 4 p.c. Stk.	105–108	..	4 16 4
560,000	,,	,,	5	Do. 3½ p.c. do.	103–105	..	4 15 3
475,000	,,	Dec. 29	3	Do. 3 p.c. Deb. Stk.	81–83	..	3 12 3
800 000	Stk.	Dec. 10	5	Continental Union, Ltd.	98–100	..	5 0 0
200,000	,,	,,	7	Do. 7 p.c. Pref.	138–140	..	5 0 0
492,270	Stk.	—	5	Derby Con. Stk.	121–123	..	4 1 4
55,000	,,	—	4	Do. Deb. Stk.	103–105	..	3 16 2
148,995	,,	Apl. 1	5	East Hull 5 p.c. Ord.	96–98*	+½	5 2 0
486,093	10	Jan. 27	12	European, Ltd.	24¼–24¾	..	4 17 0
354,060	10	,,	12	Do. £7 10s. paid.	18½–19	..	4 14 9
16,198,673	Stk.	Feb. 10	4⅝	Gas) 4 p.c. Ord.	103–104	..	4 9 8
2,600,000	,,	,,	3½	light) 3½ p.c. max.	88–90	..	3 17 9
4,062,235	,,	,,	4	and) 4 p.c. Con. Pref.	103–105	..	3 16 2
4,531,706	,,	Dec. 29	3	Coke) 3 p.c. Con. Deb.	£0–92	..	3 13 2
258,740	Stk.	Mar. 16	5	Hastings & St. L. 3½ p.c.	93–95	..	5 5 3
82,500	,,	,,	6½	Do. do. 5 p.c.	117–119	..	5 9 3
70,000	10	Sep. 29	11	Hongkong & China, Ltd.	17⅞–18	..	6 2 3
131,070	Stk.	Mar. 16	7	Ilford A and C	145–147	..	4 15 3
65,780	,,	,,	5½	Do. B	105–110	..	5 0 0
65,500	,,	Dec. 29	4	Do. 4 p.c. Deb.	100–102	..	3 18 5
4,940,000	Stk.	Nov. 11	8	Imperial Continental	180–182	+2	4 7 11
1,235,000	Stk.	Feb. 10	3½	Do. 3½ p.c. Deb. Red.	93–95	..	3 13 8
195,242	Stk.	Mar. 16	6	Lea Bridge Ord. 5 p.c.	120–122	..	4 18 4
561,000	Stk.	Feb. 25	10	Liverpool United A.	222–224	..	4 9 3
718,100	,,	,,	7	Do. B	163½–165½	..	4 4 7
306,083	,,	Dec. 29	4	Do. Deb. Stk.	103–105	..	3 16 2
75,000	5	Nov. 26	6	Malta & Mediterranean.	4⅞–5	..	6 0 0
560,000	100	Apl. 1	5	Met. of) 5 p.c. Deb.	100–102*	+2¼	4 18 0
250,000	100	,,	4½	Melbourne) 4½ p.c. Deb.	100–102*	+2¼	4 8 3
541,920	20	Nov. 11	3½	Monte Video, Ltd.	12⅞–13⅛	..	5 5 8
1,775,892	Stk.	Feb. 25	4⅝	Newc'tle & G'tesh'd Con	104–105	..	4 3 4
529,435	Stk.	Dec. 29	3½	Do. 3½ p.c. Deb.	91–93	..	3 15 3
55,940	10	Feb. 25	7	North Middlesex 7 p.c.	12⅞–13⅛	..	5 5 8
300,000	Stk.	Nov. 26	8	Oriental, Ltd.	140–142	+1	5 12 8
60,000	5	Apl. 1	8	Ottoman, Ltd.	5⅞–6⅛*	..	6 10 7
31,800	53	Feb. 25	13	Portsea Island A.	134–136	..	5 1 0
60,000	50	,,	13	Do. B.	126–128	..	5 1 7
100,000	50	,,	12	Do. C.	119–121	..	4 19 2
114,800	50	,,	10	Do. D and E.	100–102	..	4 18 0
398,490	5	Oct. 28	7	Primitiva Ord.	7⅝–7⅞	..	4 8 11
796,980	5	Jan. 27	5	Do. 5 p.c. Pref.	5⅝–5⅞	..	4 8 11
488,900	100	Dec. 1	4	Do. 4 p.c. Deb.	99–101	..	3 19 3
1,000,000	10	Oct. 14	8	River Plate Ord.	—	..	—
312,650	Stk.	Dec. 29	4	Do. 4 p.c. Deb.	99–101	..	3 19 3
250,000	10	Apl. 1	9	San Paulo, Ltd.	15–15⅛*	..	5 16 1
62,500	10	,,	6	Do. 6 p.c. Pref.	11½–12*	..	5 0 0
125,000	50	Jan. 3	5	Do. 5 p.c. Deb.	5⅛–5⅛	+⅛	4 17 1
135,000	Stk.	Mch. 16	10	Sheffield A	232–234	..	4 5 5
209,984	,,	,,	10	Do. B	232–234	..	4 5 5
523,500	,,	,,	10	Do. C	232–234	..	4 5 5
70,000	10	Oct. 14	10	South African	121–123	..	7 16 11
6,429,895	Stk.	Feb. 10	5/9/4	South Met., 4 p.c. Ord.	120–122	..	4 9 7
1,895,445	,,	Jan. 13	3	Do. 3 p.c. Deb.	81–83	..	3 12 3
209,820	Stk.	Mar. 16	8	South Shields Con. Stk.	157–158	..	5 1 3
605,000	Stk.	Feb. 25	5⅝	S'th Suburb'n Ord. 5 p.c.	121–123	..	4 12 0
60,000	,,	,,	5	Do. 5 p.c. Pref.	119–121	..	4 2 8
117,058	,,	Jan. 13	5	Do. 5 p.c. Deb. Stk.	121–123	..	4 1 4
502,310	Stk.	Nov. 11	5	Southampton Ord.	110–112	..	4 9 3
120,000	Stk.	Feb. 10	6⅝	Tottenham) A 5 p.c.	133–135	..	5 1 9
453,940	,,	,,	5⅝	and) B 3½ p.c.	112–114	..	4 14 4
149,470	,,	Dec. 29	4	Edmonton) 4 p.c. Deb.	99–101	..	3 19 3
182,380	10	Dec. 29	8	Tuscan, Ltd.	9¼–9⅝	..	8 4 2
149,900	10	Jan. 3	5	Do. 5 p.c. Deb. Red.	99–101	..	4 19 0
236,476	Stk.	Feb. 25	5	Tynemouth, 5 p c max.	112–114	..	4 7 9
255,636	Stk.	Feb. 25	6⅝	Wands-) B 3½ p.c.	139–141	..	4 14 0
79,416	,,	Dec. 29	3	worth) 3p.c. Deb. Stk.	74–76	..	3 18 11

Prices marked * are "Ex div." † Next dividend will be at this rate.

supplied within the water limits during the past year was as follows: Within the city boundary, 275,552; outside, 5848; total, 281,400. During the past year, 22,628 yards, or 12·85 miles, of new mains were laid and 173 fire-hydrants fixed, and 6788 yards of mains were taken up or disused; making a net increase of 15,840 yards, or 9 miles. The total length of mains on Dec. 31 was 267·39 miles.

NEW WATER-WORKS FOR ST. IVES (CORNWALL).

The new water-works for the supply of St. Ives (Cornwall) were formally opened yesterday week. Members of the Corporation attended the ceremony, and there was a large gathering of inhabitants of the town. Mrs. Read, wife of the Chairman of the Water Committee, opened the valve which allowed the water to flow into the town; and the Mayoress (Mrs. Williams) laid a commemoration stone. The new works were rendered necessary by the resumption of mining operations in the neighbourhood from which the town had for some years derived its water, and the mine has since attained considerable public notoriety as the one in which pitchblende, the source of radium, is found. In the new works, situated on Bussow Moors, provision is made for a supply of 250,000 gallons per day. Mr. A. P. I. Cotterell, the Engineer, originally suggested the construction of a reservoir to hold 14 million gallons; but, on the advice of the Local Government Board, it was decided that the reservoir should have a capacity of 22 millions. The catchment area amounts to upwards of 600 acres. Filter-beds are provided, and two mains, one 9 inches and the other 6 inches in diameter, convey the water to the town. Mr. A. Carkeek has carried out the work, the contract price for which was £14,640.

In explaining the construction of the works, Mr. Cotterell said the reservoir was eight acres in extent, and the top water-level 400 feet above the mean level of the sea. They had had to erect a large dam, which in one part was 40 feet deep and 15 feet wide. The mains would carry 800,000 gallons a day, if necessary; and there were three large mechanical filters, through which all the water would pass.

Alderman Read stated that the Corporation took over the water supply from a body of Trustees in 1899, and were entirely satisfied with it when the old mine workings were sold, and it became necessary to look out for a fresh source of supply. After much negotiation, it was arranged that they should have a lease of the water rights of Bussow Moor for 200 years, on a cash payment of £3000. The Local Government Board had insisted upon them having a larger scheme than was first contemplated; and he believed they were right, for a good and abundant supply of water was a valuable asset to a town which attracted so many visitors as St. Ives.

The Directors of the Imperial Continental Gas Association announce a dividend of 4 per cent. for the six months ended Dec. 31, tax free.

NOTES FROM SCOTLAND.

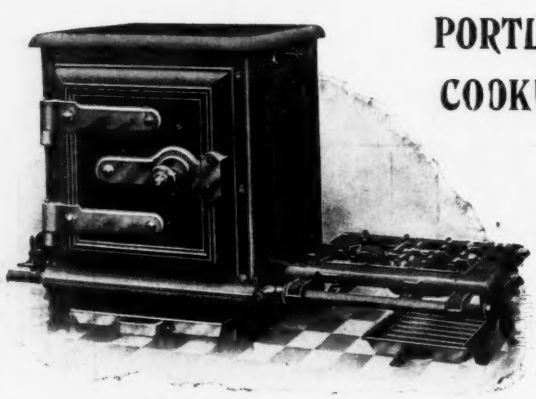
From Our Own Correspondent.

Saturday.

The hearing of the Glasgow Corporation Gas Consolidation Bill begins before a Committee of the House of Commons on Tuesday. There have been thirteen petitions lodged against the Bill. The principal opponents are the burghs of Govan, Partick, Pollokshaws, Rutherglen, and Clydebank, and the County Council of Lanark. These oppose the repeal of the clause in the Gas Act of 1862 under which the Corporation are bound to charge all consumers for lighting and domestic purposes at an equal rate, whatever the quantity of gas consumed; whereas now the Corporation are seeking power to charge consumers on a graduated scale, according to the quantity of gas burned. The petitioners also object to the continuance of the power which the Corporation have had since 1869 to apply surplus profits from the gas undertaking to the general purposes of the Corporation. The petitioners ask the Committee to find the preamble not proved until steps are taken for the formation of a Gas Board, on which all the Authorities interested would be represented.

With the meeting in Glasgow to-night of the Western District of the Scottish Junior Gas Association, the technical work of the Juniors in Scotland comes to an end for the session. There yet remains, however, a joint visit with the Eastern District to the Falkirk Gas-Works, which takes place next Saturday. The Western District have had a well-sustained and useful session; a number of valuable papers having been contributed by the members. The lecture by Mr. W. Grafton this evening was the product of deep research. The subject was well presented, and so exhaustively handled that its perusal cannot fail to extend the knowledge of those who supply gas as to the principles which underlie combustion. The red-hot flame which Mr. Grafton showed can be produced, if it should be possible to make it serve in gas-fires, would be a great acquisition to the gas industry.

Professor G. H. Gemmell, of the Royal (Dick) Veterinary College, Edinburgh, delivered a lecture on "Smoke Abatement" before the Royal Scottish Society of Arts in Edinburgh on the evening of Monday last. After dealing with the injurious effects of smoke and fog upon health and property, the author went on to say that if the smoke problem was to be solved it must be by improved methods of heating and cooking in our homes. Other methods of heating were superior in every way to the open fire. A properly constructed gas-stove, with a flue to carry away the products of combustion, although for constant work it was more costly than a coal fire, from a hygienic point of view was quite satisfactory, and did not in any way vitiate the air of a room, nor did it produce any abnormal drying effect, as was popularly supposed. It would carry off from 2000 to 4000 cubic feet of air per hour. This was a valuable ventilating effect. Another point in favour of the gas-fire was that it could be easily regulated, and the heat of a room controlled in a way not possible with coal-fires. The gas-steam radiator, or flueless condensing gas-fire, was a most economical method of heating,



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Can be placed on the Range

DURING

Summer Months.

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especially for workshops and large spaces, where there was ample ventilation. All the products of combustion passed into the air. Less gas was required to heat a room by these means than to light it by incandescent burners. A discussion followed the lecture.

The Greenock Town Council met specially on Thursday to consider the subject of extensions at the Inchgreen Gas-Works. Provost M'Millan stated that the Provost's Committee, on receiving a report from a Sub-Committee who had visited and examined the works, recommended that they should go on with the erection of two new purifiers, at a cost of £3695, and alter the existing purifiers at a cost of £775—the former to be charged to capital and the latter to revenue. Bailie Taylor, the Convener of the Gas Committee, seconded the Provost's motion to adopt the recommendation. In doing so, he said he was somewhat disappointed, because he had fully expected that the work agreed upon by the Gas Committee, to cost £9950, would have been gone on with. Bailie Bailey, assuming that what was recommended was an instalment, supported the recommendation. He thought, however, that they must be prepared to face steadily the expenditure which the Manager foreshadowed before they could be satisfied that the works were efficient. He did not think there was any cause for serious alarm; but he should like to see the Manager supported in his request for the plant and machinery necessary to produce good results. After some further discussion, the recommendation was adopted by 17 votes to 2.

On Tuesday, an inquiry was held by the Hon. Mr. Pelham, at Dunblane, into the proposed Provisional Order of the Dunblane Gas Company, Limited. Mr. Gemmell, for the Company, said that with the existing gas-works they were unable to meet the demand for gas. The works were cribbed and confined, and there was great waste. Mr. Brown, the Chairman of the Company, said that they purchased the works in 1887. For the last ten years they had been looking for a site for new works; and at the time of the negotiations with the Town Council for a transfer, the site they had now chosen was the very one which the Council had fixed upon. They were paying £35 a year feu-duty. The price which the skilled engineers of the Town Council fixed was £8000, with a make of over 9 million cubic feet of gas. Mr. Menzies, speaking for objectors, put his case purely on the ground of amenity. The houses in the vicinity would lose their value. There was another site which he believed could be got; and the gas-works should be placed there. Mr. R. Cameron, for the Parish Council, considered that gas-works upon the proposed site would depreciate the value of property in the district. Mr. Gemmell, in reply, said that the site offered that day was not 300 yards from the objectors' property. Mr. Pelham said he would visit the ground. There was a point on which he was not quite clear—that was, where the £3000 of additional capital came from. Had the Company been spending money out of revenue which should have come out of capital? It seemed to him that the original shareholders were getting 12½ per cent. for every £100. If so, it was not quite fair to the consumer. He would be glad if any further particulars as to the floating capital of the Company were sent to him in London. He had not had time to study the reserve fund. He added that the report to the Town Council by their expert might also be sent.

The shareholders of the Baillieston Gas Company, Limited, met on Tuesday, and agreed to the proposal that the undertaking of the Company should be sold to the Corporation of Glasgow at the price of £10,000, and empowered the Directors to proceed with a transfer on this footing.

At the end of last week, an extraordinary general meeting of the shareholders of the Carluke Gas Company was held, at which the Directors reported that when they built the new works in 1898 they thought they had made ample provision for any likely increase in the consumption of gas; but the increase had far exceeded their most sanguine expectations. In the last year of the old gas-works, the quantity of gas sold was 6,337,400 cubic feet; last year the quantity sold was 16,274,600 cubic feet. In eleven years the consumption had increased nearly three times; and this year the increase will be nearly a million cubic feet. The Directors have had an extension of the works under consideration for some time, and had asked Mr. L. Hislop, of Uddingston, to inspect the works and advise them. He had advised them that they should use the present retort-house as a coal-store, and build a new retort-house on the upper side, with five arches of seven retorts each, only filling three arches in the meantime with the most up-to-date system. This would give them twenty-one retorts, and with a further extension, at a very small cost, up to thirty-five. At present there are only twelve retorts. Mr. Hislop also recommended the erection of a steel gasholder tank, with a gasholder of 120,000 cubic feet capacity, which could be telescoped, increasing its capacity to 250,000 cubic feet. The estimate of the total cost was £4000; but the Directors proposed to raise £4500. They recommended Mr. Hislop's proposals, and asked power to procure the money to defray the cost. A motion of approval was unanimously adopted.

On Tuesday, a poll was taken of the ratepayers of Fraserburgh upon the question of the adoption of the Burghs Gas Supply Act of 1876. Out of an electorate numbering 2095, only 486 recorded their votes. Of these, 412 voted in favour of the adoption of the Act, and 74 voted against adoption.

Electric Short-Circuit Fires a Woman's Hat.—It may be remembered that one of the witnesses at the Clapham fire inquest stated that the breaking of an electric lamp as the result of a short-circuit would lead to fire by the dropping of the filament. A case in point recently occurred in Berlin, according to the correspondent of the "Daily News" in that city. It appears that a young woman, wearing a gorgeous spring hat, was looking into a shop-window when a short-circuit took place close to her. A spark alighted on her hat, and in a moment the straw and feathers of which it was composed were in flames. The young woman's screams brought a crowd to her aid; but in their haste to save her from the flaming hat they tore away a considerable quantity of her hair. She at once entered a claim for compensation and damage against the proprietor of the establishment.

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MAINTENANCE

The Davis Gas Stove Co., Ltd., Luton.

CURRENT SALES OF GAS PRODUCTS.

Sulphate of Ammonia. LIVERPOOL, *April* 2.

To some extent a holiday feeling has pervaded the market throughout the week, and new orders for export have been rather scarce. There has, however, been no pressure to make sales; and this fact, together with a continued good demand for home consumption, has tended to prevent any material decline in values. Prices have nevertheless again given way slightly; and the closing quotations are £12 3s. 9d. per ton f.o.b. Hull, £12 6s. 3d. per ton f.o.b. Liverpool, and £12 8s. 9d. per ton f.o.b. Leith. For future delivery no fresh business has transpired; and makers are still asking £11 17s. 6d. to £12 per ton f.o.b. at the best ports, according to the position inquired for.

Nitrate of Soda.

This article is quiet on spot, and quotations have been reduced to 9s. 9d. and 9s. 10½d. per cwt. for ordinary and refined qualities respectively.

Tar Products. LONDON, *April* 4.

The markets for tar products have been very firm throughout the past week. Pitch has shown a tendency to improve in value, and closes at decidedly higher figures. Creosote is quiet, though an improvement is looked for. Benzol is firm both for prompt and forward delivery; and for prompt delivery particularly some very good prices have been paid both in London and the North. Fifty-ninety per cent. benzol is improving in value both on account of 90 per cent. and toluol. The latter article appears to be decidedly scarce for prompt delivery; while there are numerous inquiries for forward. Solvent naphtha is very firm, and continues to be exceedingly scarce, especially in the Manchester district. Carbolic acid is quiet, and business has been done on the east coast at 1s. per gallon for delivery to the end of June. Crystals are still neglected. Cresylic acid is steady, with a tendency to improve in price. Creosote salts are in good demand. Naphthalene is selling at poor figures. Tar is very firm indeed.

The average values during the week were: Tar, 16s. 9d. to 20s. 9d. *ex* works. Pitch, London, 33s.; east coast, 33s.; west coast, 32s. to 33s. f.a.s., 33s. f.o.b. Benzol, 90 per cent., casks included, London, 8d.; North, 8d.; 50-90 per cent., casks included, London, 9d.; North, 9d. Toluol, casks included, London, 10½d.; North, 10d. to 10½d. Crude naphtha, in bulk, London, 4¼d. to 4⅜d.; North, 4d. to 4⅛d.; solvent naphtha, casks included, London, 1s. 3½d. to 1s. 4½d.; North, 1s. 3d. to 1s. 5d.; heavy naphtha, casks included, London, 1s. to 1s. 1d.; North, 11d. to 1s. Creosote, in bulk, London, 2⅛d. to 2⅜d.; North, 2d. to 2⅛d. Heavy oils, in bulk, 2⅜d. to 2⅝d. Carbolic acid, 60 per cent., casks included, east and west coasts, 1s. Naphthalene, £4 10s. to £8 10s.; salts, 40s. to 45s., bags included. Anthracene, "A" quality, 1⅛d. to 1⅜d. per unit, packages included and delivered.

Sulphate of Ammonia.

The market for this article is certainly quieter, and the demand is not quite so good. To-day, actual Beckton is quoted at £12 10s.; and outside makes upon Beckton terms are £12 5s. In Hull, £12 3s. 9d. to £12 5s. is asked; and in Liverpool, £12 6s. 3d. to £12 7s. 6d. In Leith, the price is £12 10s.; and in Middlesbrough, £12 3s. 9d. to £12 5s.

COAL TRADE REPORTS.

Northern Coal Trade.

There is a more active trade at the Northern collieries; but prices have varied of late, according to the changes in the prospects of the working of collieries. In the steam coal trade, the demand is fair, but is met by the supply, even though some collieries are still idle. Best Northumbrian steams are from 12s. 6d. per ton f.o.b.; second-class steams are from 10s. 6d. to 11s.; and steam smalls are firm and rather scarce at from 7s. to 8s. The gas coal trade shows a smaller home demand, but there are enlarging exports. Prices of the usual classes of Durham gas coals are from 10s. 3d. to 11s. 3d. per ton f.o.b., according to the quality; while for "Wear specials," from 11s. 4½d. to 11s. 9d. is quoted. A number of contracts for gas coal for delivery over the season have been concluded—including Rostock and Horsens gas coal supplies; and it is believed that for special Wear coals about 11s. 3d. per ton f.o.b. rules in these contracts. A larger one for St. Petersburg has also been given out; and the price that is named is 14s. 6d., at the Russian port, for best Durhams, to the extent of 36,000 tons. As yet, nothing appears to have been done in the great contracts for gas coal for the South. Coke is firm; and for good gas coke the current price varies from 14s. to 14s. 3d. per ton f.o.b. in the Tyne.

Scotch Coal Trade.

Trade has undergone little change. If anything, the demand for splint is slightly easier; and the same may be said of ell for shipment. The quotations are: Ell, 9s. 9d. to 10s. 6d. per ton f.o.b. Glasgow; splint, 10s. 6d. to 10s. 9d.; and steam, 10s. to 10s. 6d. The shipments for the week amounted to 329,279 tons—an increase of 42,183 tons over the previous week, and of 40,321 tons over the corresponding week of last year. For the year to date, the shipments amount to 3,411,405 tons—an increase of 552,328 tons upon the corresponding period.

It is reported that one day last week, at Cottingham, near Hull, a young servant named Maud Wilson was found dead in bed by her mistress. The room smelt strongly of gas; and it was evident that she had been suffocated while asleep. There were, however, no gas-brackets in the room; and it was not until a careful investigation had been made, that gas was found to be leaking from some pipes beneath the floor.

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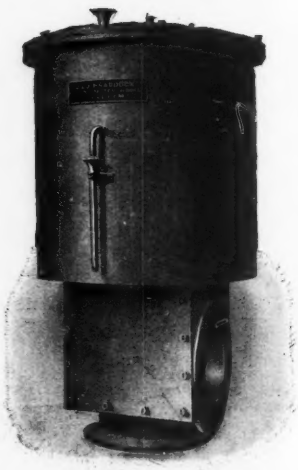
ENCLOSED RETORT-HOUSE GOVERNORS

ARE UP-TO-DATE AND RELIABLE.

SECOND TO NONE.



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Price of Electricity at Southampton.

Some discussion took place in the Southampton Borough Council on a recommendation by the Electricity Committee (among other reductions) that the charge for current for tramway purposes be reduced from 1¾d. to 1½d. per unit, and that the charge for current for heating and cooking be reduced from 1d. to ½d. per unit. They further recommended, in regard to power, a revised sliding-scale of charges for long-hour users. When moving the adoption of the report (which was ultimately agreed to with four dissentients), Mr. Lewis said they had had complaints from several large firms as to the unfair manner in which the present scale of charges for current worked out. The output of electricity was steadily increasing; and there was a large amount of power to be supplied in Southampton, if they offered it at a reasonable price. In regard to heating and cooking, the Committee suggested that the price should be reduced to ½d. per unit for those houses where a service was already laid, or would be laid, for electric light. Mr. H. F. Street (the Electrical Engineer) had estimated that at this price they would be able to compete successfully with the Gas Company in that direction. Mr. Wilding expressed the opinion that they were offering to sell their commodity at less than the cost of production, and were jeopardizing their undertaking by basing their arguments on towns which were not at all comparable with Southampton. While he had the greatest respect for Mr. Street as an Electrical Engineer, he thought he would prove mistaken as an economist; but the responsibility lay with the Council. Mr. Wood remarked that, as far as lighting was concerned, the Committee were now able to say to the public: "We can supply you with lighting as cheap as, or cheaper than, the Gas Company, for a cleaner, more convenient, better, and healthier light." Mr. M'Donnell asked if the Committee, by reducing the rate to ½d. per unit, could enter into legitimate competition with the Gas Company in connection with heating and other purposes. Did not the Gas Company offer extremely advantageous terms in connection with apparatus, and did the Committee seriously suggest that they could compete in this direction? If all the town used electric light, he would support the Committee's proposal. He pointed out that the tramway experts of the country stated that two-thirds of the corporation-run electrical undertakings were kept alive by the excessive charges made to tramway departments. It was possible, if the Committee's scheme went through, that it would mean disaster. In reply, however, Mr. Lewis pointed out that since the Committee had made reductions in their charges, they had realized more profit.

Cape Town Water Supply.—The revenue of the Cape Town Water-Works last year was £56,779, as compared with £57,880 in 1908. In consequence of the decline in the revenue, the profit realized in 1909 was £6367, compared with £8920. It appears that consumers who took considerable quantities of water through the "dribble" system have now installed meters in many cases, and this has affected the revenue.

Matlock Bath Gas-Works Question.

In the notice of the Bill promoted by the Matlock Bath and Scarthin Nick District Council, to obtain power to construct and maintain additional gas-works, which appeared in the "JOURNAL" for Feb. 1, it was mentioned that the principal clause was for the repeal of a provision in an existing Act sanctioning the raising of money for the removal of the Council's gas-works out of the area of the Matlock District Council, and imposing a penalty for failure to do this within a specified period. As soon as the Bill was presented, the Matlock Council petitioned against it, on the ground that the penalty had been imposed at considerable cost, and should be retained. The Bill was to have come before the Committee of the House of Lords presided over by the Duke of Wellington, who commence sitting to-day; but, as the result of a conference between representatives of the two bodies, the Matlock Council decided last week to withdraw their opposition. This decision has been welcomed by the inhabitants of Matlock Bath, who are relieved of the cost of removing the works.

Claim for Water for a Saw-Mill.

At the Old Street Police Court last Wednesday, the hearing by Mr. Cluer of an adjourned summons taken out by the Metropolitan Water Board against Thomas Parker, a saw-mill proprietor, of Holmes Street, Shoreditch, for non-payment of a half-year's water rate, raised some interesting points. Mr. Arnold, the collector, proved demanding the rate, which the defendant denied was chargeable. It was stated that he had paid for some four or five years; but it was admitted that he had more than once "paid under protest." Mr. Cluer asked Mr. Collins, the Assistant-Solicitor to the Board, who represented them, what more defendant could do. Mr. Collins, after some argument, produced a Private Act (embodied in the Board's Act), and showed that a notification of non-liability could only be made in writing. The defendant denied that there was any supply to the premises for the purposes of the mill boiler, though he admitted that he occasionally took water from the private service if he wanted to use the boiler—which was only seldom. The Collector said that so long as the boiler remained on the place the rate must be paid. Mr. Collins said a supply was put on at the written request of the defendant, and an adjournment had been taken to prove this; the defendant persisting in his denial. A letter requesting a supply to be laid on was now produced; and Mr. Cluer, deciding against the defendant, told him that he could only escape further liability by giving notice in writing to the Water Board to discontinue.

A Sheffield shop has been extensively damaged and slight injury caused to several persons by a gas explosion. It appears, from the newspaper reports of the occurrence, that a man from the Gas Company's offices had gone to the place to examine the meter for a leakage. Having looked at the meter, he asked for a match; and just after it was struck, the explosion took place.

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Gas Profits at Lancaster.

Moving the adoption of the minutes of the Gas Committee at the last monthly meeting of the Lancaster Town Council, Alderman Helme, M.P., drew attention to the fact that they were asking for authority to erect a workmen's mess-room at a cost of £200, to be defrayed out of the reserve fund. The estimated income, he said, was £28,234; and they had actually received £28,466—an increase of £232. The estimated expenditure was £25,847; and the probable saving on this sum would not be less than £1594—largely owing to the fact that the Committee, instead of entering into long contracts, had preferred to purchase coal from hand to mouth, and had obtained an advantage in the reduced cost. The profits, instead of being £2386 as estimated, worked out at £4214, which was a very substantial increase. They estimated for the coming year a profit of £2978. In presenting the balance-sheet, the Gas Committee were anxious to meet the Finance Committee in the disposal of the surplus over and above the £2000 which was their regular contribution to the relief of the rates; and it was suggested that the Finance Committee should take £3200, leaving £1014 to go to the reserve fund. The Chairman of the Finance Committee had since informed him they would not require the £200, as they would not be able to utilize it satisfactorily; so that, while making a contribution of £3000 to the relief of the rates, the Gas Committee were able to add £1214 to the reserve fund, which stood at £12,046, but which had been reduced to £10,423 by various works carried out. They had before them a very important expenditure in the construction of a new retort-house, which could not be long delayed, and which would cost about £12,000. They wished to maintain the reserve at this figure, so that when the work became necessary they would not have to increase the capital account. The result of their operations was that they had been able to contribute to the relief of the rates an amount equal to a 6½d. rate. The minutes were confirmed.

The Cheapest Gas in Wales.—Addressing the shareholders at the annual meeting of the Wrexham Gas Company, the Chairman (Mr. J. Oswell Bury) pointed out that, as from July 1 last, the price of gas for lighting purposes had been reduced 3d. per 1000 cubic feet, making it the same as for gas fires, cookers, &c.—2s. 3d. per 1000 feet; the charge for power purposes remaining at 2s. These charges, he said, were the lowest in the whole of Wales; and the Directors confidently hoped that, with the development of improvements in coal carbonizing, they would be in a position to make further concessions for the benefit of the consumers. Under the co-partnership scheme, the reduction in the price of gas beneficially affected the employees, who were now entitled to a bonus of 7½ per cent. on their wages. Several of the co-partners were now purchasing the Company's stock; and he hoped to see many of the workmen present at the next annual meeting. The results of the scheme had been highly satisfactory. A dividend of 5 per cent. for the year on the ordinary stock was declared; and the Chairman and Directors, the Manager (Mr. J. Braithwaite), the Secretary (Mr. W. Heyward), and the staff were thanked for their services.

Obtaining Gas by a Trick.

Last Saturday week, at Doncaster, several cases of gas stealing by means of a trick at Denaby were heard. The property inspector for the Denaby and Cadeby Main Colliery Company, during his inspection of the gas-meters at the houses of the Company's employees, found that a large number of cardboard and metal discs had been put into the slot-meters instead of pennies. At the house of Joseph Bradbury and his wife, at New Conisbro', the inspector found that 1760 cubic feet of gas had been burnt, and had not been paid for. This amount was worth 7s. 4d. Harry Owen and his wife had burnt 280 feet, worth 1s. 2d. William Bowers and his wife had obtained 220 feet, worth 11d., by using discs. The defendants pleaded guilty to the thefts of gas. They said that they were "hard up." The Company did not press the cases, and the men were fined 10s.; their wives being bound over.

Public Lighting of Merton—The Merton Urban District Council have received a letter from the Wimbledon Borough Council drawing attention to the lighting of Merton High Street, Kingston Road, and Coombe Lane, and pointing out that the Wimbledon sides of these thoroughfares are lighted with electricity, and the Merton sides with gas-lamps. It was asked if it would be possible to come to some arrangement for the even lighting of the streets. The letter was referred to a Committee. The Council have also had a communication from the Mitcham and Wimbledon Gas Company, stating that, in consequence of their revised charges, they would be able to make reductions which would mean a saving on the year of £26 7s. 8d. When these matters came before the Council, the significant remark of one member was: "I think our street lighting compares very favourably with that of Wimbledon."

Londonderry Gas Company.—At the meeting of the Londonderry Gas Company, the usual dividends of 10 per cent. on the old shares and 7 per cent. on the new, less income-tax, were declared. The Chairman (Mr. H. J. Cooke) remarked that for a number of years they had been spending a good deal of money on the works, to enable them to manufacture gas at the lowest possible price; and he thought the advantage of this was apparent when they looked down the list of gas prices in the different towns in Ireland, commencing with Dublin, where they found the price 3s. 4d., as against their 3s. 1d. per 1000 cubic feet. With the exception of Belfast and one other place, they were the lowest of any town in Ireland, which was a very satisfactory result. In the present year they hoped to complete the new gas purification scheme, which they expected would effect a very considerable saving under this head. The times were not what they used to be in the matter of earning dividends; but they had no room for discouragement. There was the gratifying fact that in the past year the output of gas had been a record for them, exceeding by some 3 per cent. that of any other year. A vote of thanks to the Directors and officials was responded to by the Chairman and Mr. R. J. Skinner, the Secretary and Manager.

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Public Lighting of Holborn.

We learn that the Gaslight and Coke Company have obtained the contract with the Holborn Borough Council for the maintenance of the public lighting, which includes lighting, extinguishing, cleaning, re-mantling, and painting and renewals to the columns, lanterns, and brackets. The contract is an annual one, and was formerly held by Messrs. S. Pontifex and Co. The whole of the lanterns are fitted with upright burners; but experiments are to be carried out with a view to putting up the latest type of inverted low-pressure gas-lamps in some of the principal thoroughfares. In Shaftesbury Avenue, the Ede-Kempton lamp, fitted with two or three burners, similar to those in use in Victoria Street and King Edward Street, will be employed; and, as mentioned last week, Messrs. D. Anderson and Co. will fix up some of their "Dacolight" lamps in Gower Street, while Messrs. Falk, Stadelmann, and Co., Limited, will put up some double-burner lamps in Hatton Garden. It is the intention of the Gaslight and Coke Company to experiment with the inverted burner on the principle of the conversion of the existing upright burner lanterns to the newer form of inverted lighting. At present the public lighting plant consists of 1896 gas-lamps, 1764 of which have single burners, 82 double burners, 28 triple burners, and 22 flat-flame burners; most of the latter being temporary lights.

Theft of Gas.—At the Wimbledon Police Court some days ago, Alfred L. Bell, an insurance agent, of Merton, was charged on remand with feloniously stealing a quantity of gas, the value of which was unknown, the property of the Mitcham and Wimbledon Gas Company. Mr. Wareham, who appeared for the prisoner, submitted that it was a case which should be dealt with under the First Offenders Act; but the Magistrates imposed a fine of £2—the alternative being fourteen days' imprisonment.

Gas and Water Charges and the Rates at Batley.—The "Yorkshire Observer" says that, from being one of the least heavily rated towns in the West Riding, Batley now bids fair to become one of the most highly rated in the locality. For many years the rates of Batley were kept down to 7s. 6d. in the pound, but of late this policy has resulted in accumulating deficit balances, and last year the rates had to be increased to 8s. 6d. Even this sum, however, has not sufficed to meet the needs of the town; and very substantial increase will have to be made in the new rate. It will be necessary to increase the price of gas 3d. per 1000 cubic feet and the price of water 1½d. per 1000 gallons to make an addition of 6d. suffice—bringing the total rate to 9s. in the pound. It is felt that the price of gas at Batley (2s. 1d. per 1000 cubic feet) and the price of water (6d. per 1000 gallons) are such that the proposed increases will not be a hardship on the consumers, as the enhanced charges will still compare favourably with those ruling in most towns. A Sub-Committee of the Finance Committee have since decided to recommend the Council to raise the price of gas from 2s. 1d. to 2s. 4d. per 1000 cubic feet, and the charge for water from 6d. to 7d. per 1000 gallons.

Gas and Commercial Securities Corporation, Limited.—The Directors of the Gas and Commercial Securities Corporation, Limited, have declared an interim dividend of 4 per cent. per annum, free of income-tax, on the ordinary shares for the period to Feb. 28.

Bexhill Water and Gas Company.—At the recent ordinary general meeting of this Company, the accounts presented for the six months ended Dec. 31 last showed that the revenue was £10,437, and the expenditure £5516; leaving £4921 to go to the profit and loss account. The amount available for distribution was £5261; and the Directors recommended dividends for the half year at the rates of £7 and £4 18s. per cent. per annum, less income-tax. This, with provision for income-tax, would absorb £3997, and leave £1264 to be carried forward. In view of a demand for gas having arisen in the hamlet of Little Common, the Directors have extended the Company's mains to that area.

North Shore (Sydney) Gas Company, Limited.—In the report of this Company for the half year ended Dec. 31 last, the Directors state that the increasing demand for gas has again necessitated an extension of the manufacturing and storage plant. A duplication of the inclined retorts, machinery, and coal-store has been commenced; and an additional gasholder, having a capacity of nearly 1,100,000 cubic feet, is now in course of construction. The general strike of coal miners at the beginning of November prevented the Directors from obtaining a sufficient supply of suitable coal, even at the high prices paid. The Company consequently suffered pecuniary loss, and the consumers much inconvenience. The net profit on the sale of gas, &c., after allowing for depreciation, was £5195; and a sum of £56 was brought forward. The transfer of £1048 from the reserve fund—making in all £6299—allowed of the payment of a dividend of 4 per cent. for the half year, free of income-tax.

New Inverted Incandescent Gas-Lamp Company, Limited.—The report of the Directors of this Company, which was presented at the ordinary general meeting last Thursday, sets forth that the net trading profit, after allowing for depreciation and all trade charges, is £6821. The balance of profit amounts to £6012, which, added to the sum brought forward, gives a total of £7490. Out of this sum, £500 has been written off patent account, bringing the total amount so written off up to £18,000; and from the balance the Directors recommend the addition of £1000 to the reserve, bringing it up to £8500, and the payment of a dividend at the rate of 6¼ per cent., free of income-tax, leaving £1035 to be carried forward. On the 14th of January last, in pursuance of the agreement entered into, the business of the Sunlight and Safety Lamp Company, Limited, at Birmingham, was taken over by the Company; and the Directors confidently expect that the amalgamation will materially strengthen the undertaking. In moving the adoption of the report, the Chairman (Mr. G. H. Cartland) said the past year had been a rather lean one; but in spite of this, the position of the Company had been strengthened. By their amalgamation with the Sunlight Company, they would be enabled to deal with people direct as manufacturers, and not simply as factors, which would be of great benefit to them in the trade. The report was adopted.

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Dissatisfaction with the Furness Co-Partnership Scheme.

Our readers will probably remember that this time last year a co-partnership scheme was entered upon for a twelve months' trial in the shipyard of Sir Christopher Furness at the Hartlepools. At the close of the period fixed upon, a ballot of the men was taken on the subject of its continuance. The result is 492 for and 598 against it; but a large number of the men abstained from voting. It is stated that the main cause of the opposition is that such irregularity of work has arisen as to furnish anything but a full year's employment for most of the men, and that the lower-paid workers, when they have been idle, have felt the need of even the few shillings they may have accumulated towards the shares. It is also stated that the co-partners are unable to obtain employment in other local yards, owing to the attitude of the men at those places. Moreover, the opinion seems to have gained ground that the scheme would act to the disadvantage of the Trade Union at a time of crisis. Mr. G. N. Barnes, M.P., the Chairman of the Labour party, referring to the adverse vote, says: "The scheme has come to the end I expected. If they [the men] were of opinion that a co-partnership scheme of any description would give them full and continuous employment they must have been exceedingly simple. The movement is not consistent with the principles of Trade Unionism, because it isolates the men from their fellows. The effect of such schemes is to split up workmen into groups, and make them selfish." Mr. Barnes, referring to the co-partnership scheme of the South Metropolitan Gas Company, says: "There you have the men living in a world of their own, knowing practically nothing about the outside world of industry."

Publication of Coal Contracts at Salford.

The "Manchester Courier" says that, after an agitation extending over a number of years, during which the question of the publication of coal contract prices has been one of the main planks in the programmes of candidates for municipal honours, the Salford Council, on July 7 last, passed the following resolution: "Publication of contract prices—That in future the prices paid for coal and cannel by the Gas and Electricity Committees, and the terms and conditions of agreements entered into by the Electricity Committee, shall appear on the *agenda* of the Council before acceptance." The result of the passing of this resolution was discussed at a special meeting of the General Purposes Committee last Friday. It was stated that the Corporation required for the ensuing twelve months about 160,000 tons of coal and cannel; and the tenders submitted disclosed an approximate increase in the price over that of last year of 1s. per ton, or an aggregate advance of £8000 per annum. The seriousness of the matter is apparent when it is pointed out that the added cost of the coal means no less than a 2d. rate in the borough. Inasmuch as the tenders were practically similar, the existence of a coal ring was said to be manifest. Prior to the passing of the resolution recorded above, the Gas Committee were enabled to negotiate for more favourable terms; and Alderman Phillips, the Chairman, has repeatedly claimed that this has been the means of saving the Corporation many thousands of pounds annually. Negotiations, however, are entirely impossible under the terms of the resolution; and it would appear that the Council have landed themselves into a quandary. After a heated discussion, the General Purposes Committee resolved to readvertise for tenders, and to intimate that the lowest offers now would be accepted.

Walton-on-Thames District Council and the Standard Burner Bill.—The above-named Council have lately been conferring with the Walton-on-Thames and Weybridge Gas Company on the subject of the proposals contained in the Standard Burner Bill, in the promotion of which they are associated with other gas companies. As a result, the Company have agreed to reduce the price of gas 1d. per 1000 cubic feet as from the 25th ult.; and the Council have withdrawn their opposition to the Bill.

Sale of Shares.—At a recent sale of shares at the Queen's Arms Hotel, Rawtenstall, £10 old shares in the Rossendale Union Gas Company fetched £21 1s. 3d. each; £10 shares (1876 Act), £12 8s. each; £10 Amendment Act shares, £16 12s. each; £10 new Amendment Act shares, £13 13s. apiece; and 5 per cent. £10 preference shares (£4 paid), £5 each. On the same occasion, some £10 "A" shares in the Haslingden Union Gas Company realized £21 7s. per share; a few £10 "B" shares in the same concern fetching £16 6s. each.

Laindon Gas-Works for Sale.—It will be seen, from an advertisement which appears elsewhere, that Mr. William Richards, of the firm of Messrs. A. & W. Richards, will offer for sale at the Mart, Tokenhouse Yard, E.C., next Tuesday, under instructions from the High Court of Justice, the freehold gas-works of the Laindon and District Gaslight, Coke, and Water Company, Limited. In addition to the works, which are about 23 miles from London, there are approximately 1¾ miles of mains and services to 51 consumers. The whole will be sold as a going concern, and possession will be had on completion of the purchase.

Whitby Gas Company.—The accounts for the past year which were presented at a recent meeting of this Company showed that the revenue amounted to £9011, and the expenditure to £6834; leaving £2177 to go to the profit and loss account. The balance available for distribution was £966; and the Directors recommended dividends at the rates of £3 and £2 2s. per cent. (less income-tax) on the original and additional capital respectively for the six months ended Dec. 31; making with the interim dividends £6 and £4 4s. per cent. for the year. There was an increase of gas sold to the extent of more than 1¼ million cubic feet compared with 1908. In moving the adoption of the report, the Chairman (Mr. Freeman Richardson) said the Directors had been able to reduce the cost of coal by £243, and that of purification by about £16. Wages showed a slight decrease; and the total expenditure was a little less than before. The sale of gas produced an increase of £234, which would have been highly satisfactory had not the value of residual products unfortunately fallen approximately to the same extent, due to the lower prices obtained for coke and tar. The dividends recommended were declared; and votes of thanks were accorded to the Directors, officers, and staff.

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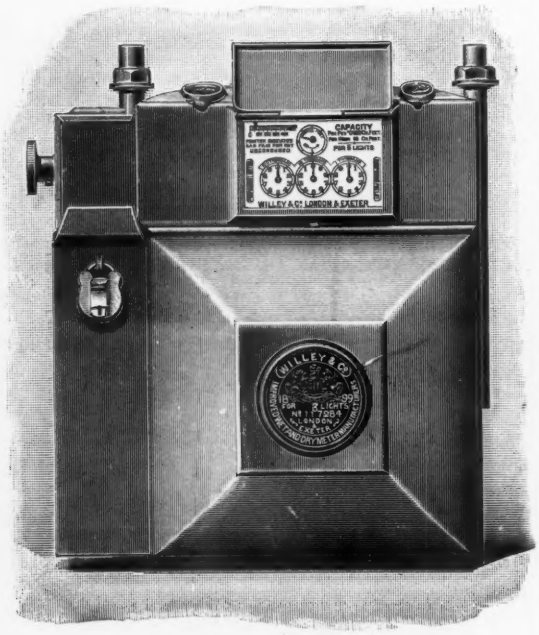

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A St. Helens man, named Harry Porter, who had suffered from influenza, was found on his bed dead, having inhaled gas through an india-rubber tube, one end of which was attached to a gas-bracket.

The Londonderry Corporation are wishful to borrow £10,000 for extensions of their electricity undertaking; and accordingly a Local Government Board inquiry has been held by Mr. P. C. Cowan. In the course of the proceedings, Mr. Macrory, the Electrical Engineer, stated the cost of production and the rates charged, upon which the nspector said it appeared to him they were losing on every unit they sold. Mr. Macrory replied that, taking the private lighting by itself, they were losing on every unit; but the public lighting came in, and owing to the fact that carbons and trimming had to be charged to the public lighting, a higher average price per unit was obtained.

We have received from the Collapsable Grill Tin and Grid Company, of Newcastle (Staffs), one of their tins and grids constructed according to the patent taken out a few months ago by Mr. A. A. T. Botteley, the Manager of the Chesterton Gas-Works. When using the ordinary shallow tin under a cooker grill, it has to be packed up if it is desired to bring it nearer the flame. This is avoided with Mr. Botteley's tin, which, by simply pressing the handle, can be lowered to the extent of an inch, or raised a corresponding height by a slight pressure of the thumb on a ring that slides through the handle, without drawing the tin from under the grill. The new grill tin should prove a useful adjunct to the gas-stove.

The Aldeburgh Town Council, at a special meeting last Friday, passed the following resolutions: "(1) That the Corporation make application to the Board of Trade for the grant of a Provisional Order under the Electric Lighting Acts, 1882 to 1909, for the supply of electricity in the borough, including the districts of Thorpe and Hazlewood; and subject thereto (2) that the Committee submit to the Board of Trade for its approval the Rural Electricity Supply Company, Limited, as the Company to be named in the clause to be inserted in the Provisional Order, to accept a transfer of the powers of the Corporation, and to execute the works under the Order, subject to such provisions, stipulations, and conditions as may be approved by the Board of Trade."

One by one the few survivors of the Balaclava charge—the "noble six hundred"—are dropping off. One of the latest to join the majority was William Freestone, a private in the 4th Hussars (the old 4th Light Dragoons), who served throughout the Crimean War, and was in receipt of a special campaign pension. After leaving the Army he joined the Metropolitan Police, and while on mounted duty at Ascot sustained concussion of the brain through stopping a racehorse which had escaped from the paddock. As the result, he was invalided on pension. He subsequently obtained employment as gatekeeper at the works of the Wandsworth and Putney Gas Company. While engaged in his duties he, by a strange coincidence, recently fell downstairs and fractured his skull.

WANTED, FOR SALE, CONTRACT, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

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WIGAN GAS DEPARTMENT. Tenders by April 18.

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LIMERICK GAS COMMITTEE. Tenders by April 18.

Sulphuric Acid.

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COLNE GAS DEPARTMENT. Tenders by April 23.
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COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office NOT LATER than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders for Alterations in, or stoppages of, PERMANENT ADVERTISEMENTS should be received by the FIRST POST on SATURDAY.

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Address Correspondence and Inquiries to Oldbury, Worcs.
Telegrams: "Chemicals, Oldbury."

"V.S.C." PAINT FOR GAS-WORKS PLANT.
JOHN E. WILLIAMS AND CO.,
LOWER MOSS LANE,
MANCHESTER, S.W.
Telegrams: "Enamel." National Telephone 1759.

PATENTS AND TRADE MARKS
PUBLICATIONS, "MERCHANDISE MARKS ACT, and Decisions thereunder," 1s.; "TRADE SECRETS v. PATENTS," 6d.; "DOCTRINE of EQUIVALENTS, Mechanical and Chemical," 6d.; "SUBJECT-MATTER of PATENTS," 6d.
MEWBURN, ELLIS, & PRYOR, Chartered Patent Agents, 70 & 72, Chancery Lane, London, W.C. Telegrams: "Patent London." Telephone: No. 243 Holborn.

AMMONIA.
Consumers in any form are invited to correspond with Chance and Hunt, Ltd., Chemical Manufacturers, Oldbury, Worcs.

OXIDE OF IRON
(NATURAL)
FOR GAS PURIFICATION.
NEW WESTBURY IRON COMPANY, LTD.
WESTBURY, WILTS.

"GAZINE" (Registered in England and Abroad). A radical Solvent and Preventative of Naphthalene Deposits, and for the Automatic Cleaning of Mains and Services.
It is also used for the enrichment of Gas.
Manufactured and supplied by C. Bourne, West Moor Chemical Works, Killingworth, or through his Agent, F. J. Nicol, Pilgrim House, Newcastle-on-Tyne.
Telegrams: "Doric," Newcastle-on-Tyne. National Telephone No. 2497.

J. E. C. LORD, Ship Canal Tar Works,
Weaste, Manchester. Pitch, Creosote, Benzols, Toluol, Naphtha, Pyridine, all kinds of Cresylic Acid, Carbolic Acid, Sulphate of Ammonia, &c.

TAR WANTED.
Telephone: Central Manchester, 7002.
Telegrams: "UPRIGHT."
Apply, THOMAS HORROCKS,
Albert Chemical Works, BRADFORD,
MANCHESTER.
Pitch, Creosote, Brick and Fuel Oils, Benzol, Solvent Naphtha, Carbolic, Sulphate of Ammonia.

R. & G. HISLOP,
GAS ENGINEERS, RETORT BUILDERS,
CONTRACTORS, &c.
RETORT SETTINGS, COAL-TESTING PLANT,
BOILER FIRING.
Underwood House, PAISLEY.

GEO. NEWTON, Limited,
Wires: "Automatic, Manchester."
40 YEARS' REPUTATION.
WET, DRY, ORDINARY and PREPAYMENT, STATION METERS, &c.
Late of Oldham—Note *new* Address:—
39, RIVER STREET, HULME, MANCHESTER.

METER INDICES
WITH AND WITHOUT DIALS.
A. ROUX & CO., Limited,
9, Southampton Street, Holborn, W.C.
MOVEMENTS FOR CLOCKS, PHOTOMETERS and BAROGRAPHS, WHEELS, PINIONS, and WORMS.
WORKS, HANDSWORTH, BIRMINGHAM.

FIDDES-ALDRIDGE
SIMULTANEOUS Discharging-Charger.
The one Machine which Discharges and Charges at One Stroke.
See Advertisement, March 8, p. III. of Centre.
ALDRIDGE AND RANKEN,
89, Victoria Street, Westminster, S.W.
Telegrams: "Motorpathy, London." Telephone: 5118 Westminster.

HYDRATED OXIDE OF IRON.
PREPARED from Pure Iron.
Twice as Rich as Bog Ore.
Gives no back Pressure.
The Cheapest in the Market.
Read Holliday and Sons, Ltd., Huddersfield.

SATURATORS made or Repaired.
Reasonable Terms (workmanship guaranteed) by a 30 Years' Saturator Maker (Labour and Plant only), at per Hour or Contract. Saturators improved. Perfect Mixing and Noiseless.
Davies, General Chemical Plumber and Leadburner, 117, Gallaway Road, Shepherd's Bush, W.

GAS PLANT for Sale—We can always offer NEW and SECOND-HAND GAS APPARATUS, including Retorts and Fittings, Condensers, Exhausters, Scrubbers, Washers, Purifiers, Gasholders, Tanks, Valves, Connections, &c. Also a few COMPLETE WORKS. Compare Prices and Particulars before ordering elsewhere.
Firth Blakeley, Sons, and Company, Limited, Thornhill, Dewsbury.

GAS TAR wanted,
Brotherton and Co., Ltd., Tar Distillers.
Works: Birmingham, Glasgow, Leeds, Liverpool, Wakefield, and Sunderland.

GAS-WORKS requiring Extensions should Communicate with FIRTH BLAKELEY, SONS, AND CO., LIMITED, Dewsbury, who make a Speciality of Catering for the Smaller Gas Concerns. Prices Reasonable; quality and results, the *best*. Satisfaction Guaranteed.

CAST-IRON Pipes. Spigot and Socket or Flanged. Special Quality—9 feet or 12 feet Lengths. When buying, Write us.
A. Lowcock, Limited, Shrewsbury.

AMMONIA Waste Liquor Disposal.
Purification Plant.
Results Guaranteed. No Working Costs.
John Radcliffe, Chemical Engineer, East Barnet.

APPLICATIONS FOR APPOINTMENTS.
DO you appreciate how much success depends on well-considered and lucid presentment of your qualifications? I make a Specialty of the Preparation of Applications, and am continually receiving complimentary letters from clients. Write now for Particulars.
Herbert Greatorex, Beechwood, Matlock.

ADVERTISER, with Twenty Years' Ex- perience in best Class of Gas-Fitting in Gentlemen's Country Mansions, seeks Re-Engagement as FOREMAN or LEADING HAND at ACETYLENE or PETROL LIGHTING. Well up in Converting and Re-Lacquering Fittings and Estimating. Highest References.
Address No. 5214, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

DRAUGHTSMAN (Assistant) wanted.
One accustomed to Gas Lighting, Heating, and Cooking Apparatus preferred.
Apply, by letter, giving the Names of Firms where previously employed and stating Age and Salary required, to No. 5211, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

THOROUGHLY up-to-date and pushing TRAVELLER required by a well-known Gas Fittings and Apparatus Firm for London and Suburbs. Only those with a sound Connection among Gas Companies and Ironmongers need Apply. Salary no object to the right man.
Apply, by letter, to No. 5210, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

TO GAS MANAGER'S OR GAS ENGINEER'S SON.
SUITABLE Man Wanted to Act as CLERK OF WORKS during Erection of an 8 Million Cubic Feet Works, Take Charge of Laying Mains and Services, and later on to Act as MANAGER and SECRETARY. Preference will be given to one investing a fair amount in Shares. Splendid Prospects.
Apply, by letter, stating Age, Experience, and Wages, to No. 5209, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

FOR SALE—One 150-Burner Complete Plant made by the National Air Gas Company, Limited. Nearly new and in good order.
Can be seen by Appointment at Messrs. Charrington and Co., Ltd., Anchor Brewery, Mile End, E.

WANTED, a Reliable Second-Hand Gas- METER TESTING PLANT. Must be in thorough working order.
Address, giving lowest Price and full Particulars, to No. 5212, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

GASHOLDERS—Splendid 45 feet dia- meter and New STEEL TANK, fixed Complete to Plan and Specification; also 14 feet and 16 feet Diameter GASHOLDERS, with STEEL TANKS. Can be seen temporarily erected. Re-erected Cheap for immediate Sale.
Firth Blakeleys, Thornhill, Dewsbury.

COUNTY BOROUGH OF SALFORD.
(Gas Department.)
AMENDED ADVERTISEMENT.

THE Gas Committee invite Tenders for the Supply of COAL and CANNEL required at their Works during a period of One Year.
The lowest prices must be quoted, as no reduction of or rebate in such prices will be expected.
Forms of Tender may be obtained on Application to Mr. Wm. W. Woodward, Engineer, Gas Offices, Bloom Street, Salford.
Sealed Tenders, endorsed "Tender for Coal," addressed to the Chairman of the Gas Committee, Town Hall, Salford, to be delivered to me not later than Three p.m. on Wednesday, the 13th of April, 1910.

L. C. Evans,
Town Clerk.

Town Hall, Salford,
April 1, 1910.

GAS COMMITTEE FOR THE CITY OF LIMERICK.
TO RETORT SETTERS AND OTHERS.

THE Gas Committee are prepared to re- ceive TENDERS for RETORT-SETTING, &c., required by them at their Works, Dock Road, Limerick.
Full Particulars and Form of Tender can be obtained from the Engineer and Manager, Mr. H. Hawkins.
Tenders, endorsed "Retort-Setting, &c.," addressed to the Chairman, Gas Committee, Gas Offices, William Street, Limerick, to be sent in not later than Five p.m. on April 18, 1910.
The Committee do not bind themselves to accept the lowest or any Tender.

By order,
H. Hawkins,
Engineer and Manager.

Gas-Works, Limerick,
March 22, 1910.

GAS COMMITTEE FOR THE CITY OF LIMERICK.
TENDERS FOR OXIDE, &c.

THE Gas Committee for the City of Limerick invite TENDERS for the Supply of 200 Tons of NEW OXIDE, to be delivered at the Gas-Works, Dock Road, Limerick; also for the purchase of about 250 Tons of SPENT OXIDE, delivered f.o.b. Limerick Docks.
Samples of the New Oxide tendered for must be sent with each Tender with full Particulars.
Tender Forms can be obtained from the Engineer and Manager, Mr. H. Hawkins.
The Committee do not bind themselves to accept the lowest or highest Tender, as the case may be.
Tenders to be sent in not later than Five p.m. on April 18, 1910, addressed to the Chairman, Gas Committee, Gas Offices, Limerick.

By order,
H. Hawkins,
Engineer and Manager.

Gas-Works, Limerick,
March 22, 1910.

BOROUGH OF COLNE.
(GAS DEPARTMENT.)

THE Gas Committee invite Tenders for the Surplus TAR made at their Works during the Twelve Months ending March 31, 1911.

Particulars may be obtained on Application to the undersigned.

Sealed Tenders, endorsed "Tar," must be addressed to the Chairman of the Gas Committee, Gas-Works, Knotts Lane, Colne, Lancashire, and delivered not later than Saturday, the 16th day of April, 1910.

The highest or any Tender not necessarily accepted.

FRED. THORPE,
Engineer and Manager.

Gas-Works, Colne, Lancashire,
March 29, 1910.

BOROUGH OF DARWEN.

TENDERS FOR GAS SLACK AND NUTS.

THE Gas Committee of the above Cor- poration are prepared to receive TENDERS for the Supply of Rough GAS SLACK and NUTS for One Year, to be delivered at the Gas-Works Siding in Corporation Waggons.

Forms of Tender and all Information as to Quantities may be obtained on Application to Mr. A. H. Smith, Gas Engineer, Darwen.

Sealed Tenders, endorsed "Gas Slack," must be delivered to the undersigned not later than Saturday, the 23rd day of April, 1910.

No Tender necessarily accepted.

By order,
WILLIAM P. HALLIWELL,
Town Clerk.

Town Clerk's Office,
Darwen, March 23, 1910.

BOROUGH OF DARWEN.

TENDERS FOR TAR.

THE Gas Committee of the above Cor- poration are prepared to receive TENDERS for all the Surplus TAR produced at their Gas-Works for One Year.

Further Particulars and Forms of Tender may be obtained on Application to Mr. A. H. Smith, Gas Engineer, Darwen.

Sealed Tenders, endorsed "Tender for Tar," must be delivered to me, the undersigned, not later than Saturday, the 23rd day of April, 1910.

The highest or any Tender not necessarily accepted.

By order
WILLIAM P. HALLIWELL,
Town Clerk.

Town Clerk's Office,
Darwen, March 23, 1910.

BOROUGH OF DARWEN.

THE Gas Committee of the above Cor- poration are prepared to receive TENDERS for the Supply of the following GOODS for One Year :—

Benzol.
Wrought-Iron Tubes and Fittings.
Cast-Iron Mains and Specials.
Brass Fittings.
Gas Wash Boilers.

Full Particulars and Forms of Tender may be obtained on Application to Mr. A. H. Smith, Gas Engineer, Darwen.

Sealed and Endorsed Tenders must be delivered to me, the undersigned, not later than Saturday, the 23rd day of April, 1910.

The lowest or any Tender not necessarily accepted.

By order,
WILLIAM P. HALLIWELL,
Town Clerk.

Town Clerk's Office,
Darwen, March 23, 1910.

SUTTON-IN-ASHFIELD URBAN DISTRICT COUNCIL.

GAS-WORKS EXTENSION.

PERSONS desirous of Tendering for the Erection of a THREE-LIFT GASHOLDER of 600,000 Cubic Feet capacity (and alternatively, for a TWO-LIFT GASHOLDER of 400 000 Cubic Feet capacity) are requested to send their Names and Addresses to Messrs. Corbet Woodall and Son, Palace Chambers, Bridge Street, Westminster, S.W., not later than Monday, the 11th day of April, 1910, together with a deposit of £3 3s. (by Cheque) for Copies of Drawings, Specification, Form of Tender, and Bill of Quantities.

The Deposit will be returned on receipt of a *bonâ-fide* Tender.

The lowest or any Tender will not necessarily be accepted.

JOHN D. FIDLER,
Clerk to the Council.

Council Offices,
Sutton-in-Ashfield.

COUNTY BOROUGH OF WIGAN.
(GAS DEPARTMENT.)

THE Gas Committee invite Tenders for the Supply of STORES over the Year ending on March 31, 1911, as follows:—

(*a*) Wrought-Iron Tube and Fittings.
(*b*) Brass and Copper Tube and Fittings.
(*c*) Lead Gas Pipe.
(*n*) Cast Mains and Connections.
(*q*) Sulphuric Acid.
(*r*) Surplus Tar.

Forms of Tender may be obtained from the undersigned.

The Committee do not bind themselves to the acceptance of any Tender.

Tenders, sealed and endorsed with the name of the article tendered for, to be delivered to Harold Jevons, Esq., Town Clerk, Wigan, on or before Monday, the 18th of April next ensuing.

A Sample of each Article to be forwarded, addressed to the Gas Engineer.

JOS. TIMMINS, M.Inst.C.E.,
Engineer, &c.

Borough Gas-Works,
March 30, 1910.

CEFN Mawr and Rhosymedre Gas Com- pany, Limited, Ruabon, invite TENDERS for one GENERATOR or REGENERATOR SETTING OF SIX RETORTS, with MOUNTINGS, HYDRAULIC and FOUL MAINS Complete, and Sectionizing of Two existing Beds.

Further Particulars from Mr. MOULT, the Manager.

BRIDGEWATER COLLIERIES COKE-WORKS.
(THE EARL OF ELLESMERE.)

TENDERS are invited for the Crude BENZOL produced at the above Works (estimated at 8000 to 10,000 Gallons per Month) testing 80 per cent. at 120° C., during the next Three, Six, Nine, or Twelve Months, delivered into Contractor's Tanks at the Bridgewater Colliery Siding, Wharton Hall, on the Pendleton and Hindley Branch of the Lancashire and Yorkshire Railway, or at the Brackley Siding on the Little Hulton Mineral Branch of the London and North Western Railway.

Tenders, endorsed "Tender for Crude Benzol," to be addressed to Mr. Thomas M. Brown, Bridgewater Coal Offices, 4, Chapel Walks, Manchester, not later than the 25th inst.

Manchester, April 5, 1910.

KILMARNOCK CORPORATION.
(GAS DEPARTMENT.)

THE Gas Department of the above Cor- poration have for DISPOSAL at their Langlands Street Works, Kilmarnock, the following SECOND-HAND PLANT:

RETORT BENCH MOUNTINGS, consisting of Mouthpieces, Ascension, Bridge, and Dip Pipes, Hydraulic Main, Connections, Valves, Bench Binding Frame, &c.; one Kirkham, Hulett, and Chandler Horizontal Rotary WASHER SCRUBBER, One Million Cubic Feet per day capacity, Complete with driving gear; One GAS EXHAUSTER COMPENSATOR; One TRAVELLING LIFTING CRANE for Purifiers; Cylindrical STATION METER, with Bye-Pass Complete; Tangyes STEAM PUMP for Tar; COAL TESTING PLANT, Complete for a Charge of ½ cwt.; Three Tons per day "Gillespie" SULPHATE PLANT, Complete in every respect.

In addition to the above, there is a large assortment of CAST-IRON GAS-PIPE CONNECTIONS 12-inch to 15-inch diameter, as well as an assortment of COAL BOGIES, COKE BARROWS, and GAS-WORKS TOOLS.

Particulars will be supplied on Application.

Offers for any portion of the foregoing Plant will be received up till Tuesday, April 26, 1910.

WM. & CHAS. FAIRWEATHER,
Joint Managers.

Gas Offices, Kilmarnock,
April 2, 1910.

ISLE OF THANET GASLIGHT AND COKE COMPANY, MARGATE.

TENDER FOR COAL.

THE Directors of the above Company are prepared to receive TENDERS for the Supply of COAL for One Year from May 1, 1910, for their Works at Margate.

The quantity required is 30,000 Tons (comprising 10,000 Tons of Good Yorkshire Washed Nuts, and 20,000 Tons of Good Durham Unscreened Gas Coal), such Nuts and Coal to be delivered at the Quayside, Margate, in Monthly Quantities according to Schedule.

The Gas Company will unload the Nuts and Coal into their carts, and will also pay the Pier and Harbour Dues of 1s 3d. per Ton. All other costs and charges must be paid by the Vendor; and it is to be noted that barges can generally be accommodated, or steamers, having a draught of about 10 or 11 ft., at Spring tides only. The Company have their own steam crane at the Quayside, Margate, and can discharge at a Maximum Rate of about 200 Tons per day.

Tender Forms and any further Information required will be supplied on Application to the Company's Engineer and Manager, Mr. J. M. Campbell.

Sealed Tenders, endorsed "Tender for Coal," addressed to the Chairman, are to be sent in not later than the 20th of April, 1910.

The Directors do not bind themselves to accept the lowest or any Tender.

By order,
THOS. C. FULLER, F.C.I.S.,
Secretary.

Offices: Addington Street,
Margate, March 31, 1910.

THE Owner of Patents No. 90, of 1906, and No. 14,189, of 1906, relating to "Improvements in Tubes made of Spirally Wound and subsequently Soldered Metallic Strips and Process of Manufacturing the same," and "Improvements in Machines for the Manufacture of Tubes from Metal Strips," desires to Negotiate with Manufacturers with the view of Granting LICENSES under them upon Reasonable Terms. For Information, Apply to LLOYD WISE AND CO., Chartered Patent Agents, 46, LINCOLN'S INN FIELDS, W.C.

THE Proprietors of the Patents Nos. 24,218 of 1901 and 83 of 1901, for "IMPROVEMENTS relating to MACHINES FOR THE MANUFACTURE OF MANTLES EMPLOYED IN INCANDESCENT LIGHTING" and "IMPROVEMENTS relating to MACHINES FOR THE MANUFACTURE OF INCANDESCENT GAS MANTLES," are desirous of entering into Arrangements, by way of LICENSE and Otherwise, on Reasonable Terms, for the purpose of EXPLOITING the same and ensuring its Full Development and Practical Working in this Country.

All Communications should be addressed in the first instance to HASELTINE, LAKE, AND CO., Chartered Patent Agents and Consulting Engineers, 7 & 8, Southampton Buildings, Chancery Lane, LONDON, W.C.

WANTED, Shares in a Sound Gas Company.

State lowest price to No. 5213, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

SALES BY AUCTION OF GAS AND WATER STOCKS AND SHARES.

MESSRS. A. & W. RICHARDS beg to notify that their SALES BY AUCTION of NEW CAPITAL ISSUED UNDER PARLIAMENTARY POWERS, and of STOCKS and SHARES belonging to EXECUTORS and other PRIVATE OWNERS in LONDON, SUBURBAN, and PROVINCIAL GAS and WATER COMPANIES, take place PERIODICALLY at the Mart, TOKENHOUSE YARD, E.C.

Terms for Issuing New Capital, and also for including other Gas and Water Stocks and Shares in these Periodical Sales, will be forwarded on Application to MESSRS. A. & W. RICHARDS, at 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the

SOUTHEND WATER-WORKS COMPANY.

NEW ISSUE OF 1000 NEW ORDINARY FIVE PER CENT. MAXIMUM £10 SHARES.

MESSRS. A. & W. RICHARDS will SELL THE ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, April 19, at Two o'clock, in Lots.

Particulars of the AUCTIONEERS, 18, FINSBURY CIRCUS, E.C.

In the High Court of Justice, Chancery Division,
Mr. Justice Joyce. 1909, L. No. 1586.

THE FREEHOLD GAS-WORKS
OF THE
LAINDON AND DISTRICT GASLIGHT, COKE AND WATER COMPANY, LIMITED,

Situate about 23 miles from London, within a short distance of the Laindon Station on the London, Tilbury, and Southend Railway. The Works comprise: **Retort House** with Eight Retorts, Vertical Condenser, Cast-Iron Scrubber, Tar-Tank and Pump, Two Purifiers, with Lifting and Traversing Apparatus, **Gasholder, 400-Light Station Meter,** together with the Mains, Services, Meters, and Tools, the whole **to be sold** as a **Going Concern** and with **Possession on completion of the purchase.**

MR. WILLIAM RICHARDS, of the Firm of **MESSRS. A. & W. RICHARDS** (the person appointed by the said Judge), will SELL THE ABOVE BY AUCTION, at the Mart, London, E.C., on Tuesday, April 12th., at **One** o'clock, precisely in One Lot.

The Works may be viewed, and Particulars with Conditions of Sale obtained, of J. MONTAGUE HASLIP, Esq., Solicitor, 6, Martin's Lane, CANNON STREET, E.C.; of HARRY BARKER, Esq., Chartered Accountant, 6, OLD JEWRY, E.C., and of the AUCTIONEERS, 18, FINSBURY CIRCUS, E.C.

THE
Sir John Cass Technical Institute,
JEWRY STREET, ALDGATE, E.C.

The following Special Courses of Instruction will be given during the Summer Term, 1910:—

TECHNICAL GAS ANALYSIS.

By CHARLES A. KEANE, D.Sc., Ph.D., F.I.C.

A Course of Practical Work suited to the requirements of those engaged in Chemical and Metallurgical Industries. Wednesday Evenings, 7 to 10 p.m. Commencing **Wednesday, April 20, 1910.**

FUEL ANALYSIS.

By C. O. BANNISTER, Assoc.R.S.M., M.I.M.M.

A Course of Laboratory Work in the methods employed for the Analysis and Examination of Fuels arranged to meet the requirements of Technological Students engaged in Chemical and Metallurgical Industries. Monday Evenings, 7 to 10 p.m. Commencing **Monday, April 18, 1910.**

Detailed Syllabus of the Courses may be had upon Application at the Office of the Institute, or by letter to the **Principal.**

A HANDSOME F'CAP VOLUME GIVING AN ACCOUNT OF THE

GRANTON GAS-WORKS

of the Edinburgh and Leith Corporations' Gas Commissioners,

Their Design, Construction, and Equipment, with Illustrations, Plates, and Details of Costs.

By W. R. HERRING, M.Inst.C.E., &c.

Bound in Cloth, price 16s. net cash, free delivery in United Kingdom.

WALTER KING, 11, Bolt Court, FLEET STREET, E.C.

THOMAS DUXBURY & CO.,
16, DEANSGATE, MANCHESTER.

Best Gas Coal and Cannel, giving High Illuminating Power, Large Yield per ton, and reasonable in Price.

Telegrams: "DARWINIAN, MANCHESTER."
Telephone 1806.

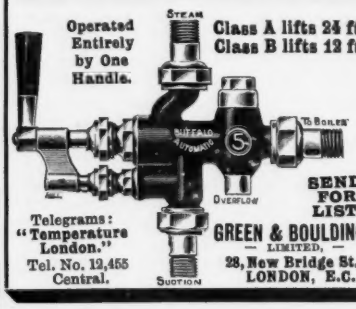
ARMSTRONG'S
PATENT
CANDLE SAFETY LAMPS.
Are a great improvement on Oil, giving a good Light, requiring little or no Cleaning, and when once lighted no further attention is necessary. The Candles are made to burn 5, 7, or 9 hours.
43, Manchester Street, Gray's Inn Road, W.C.

MIRFIELD GAS COAL.
UNEQUALLED.
Sperm Value 878·85 lbs. per Ton.
Please apply for Price, Analyses, and Report, to the
MIRFIELD COLLIERY COMPANY,
RAVENSTHORPE, NEAR DEWSBURY.
LONDON: 16, Park Village East, N.W.

JOHN HALL & CO. OF STOURBRIDGE,
LIMITED,
STOURBRIDGE,
Manufacturers of
FIRE-BRICKS, LUMPS, TILES,
GAS RETORTS,
And every description of Fire-Clay Goods.
RETORTS CAREFULLY PACKED FOR SHIPMENT.

LUX'S
Gas Purifying Material
is now used in many Gas-Works throughout Scotland with gratifying success.
FRIEDRICH LUX
Ludwigshafen-am-Rhein
Sole Agent for Scotland:
DANIEL MACFIE
1, North Saint Andrew Street, EDINBURGH
Telegrams: "GASLUX, EDINBURGH"
Descriptive Pamphlet on Application.

Testing Instruments
ALEXANDER WRIGHT & CO., Ld.
WESTMINSTER.

'BUFFALO' INJECTOR
Operated Entirely by One Handle.
Class A lifts 24 ft.
Class B lifts 12 ft.


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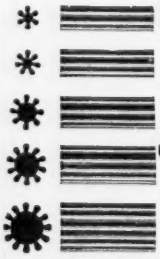
Telegrams: "Temperature London." Tel. No. 12,455 Central.
GREEN & BOULDING, — Limited, —
28, New Bridge St., LONDON, E.C.

JOHN COATES & CO., LTD.,
Gas and Water Works Engineers, Inspectors, and Merchant Shippers,
5, Laurence Pountney Hill, LONDON, E.C.
NOTE. Much expense and trouble is often saved by Colonial and Foreign Gas and Water Companies, and City Corporations, by having their requirements from Great Britain bought or properly inspected by practical men. We have a staff of experts for Buying, Shipping, and Inspection, of Gas Plant and Machinery of every description, Cast Iron Pipes, &c., and may add that our Engineering Branch is under the direction of Mr. John Coates, M.Inst.C.E., and Shipping Branch under Mr. Alfred J. Kingdon, both with over 20 years' experience.
J. C. & Co.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any lengths.
John Rigby & Sons, Ld.
Rawfolds Wire Mills, *CLECKHEATON.*
Head Office & Works:
Adelphi Wire Mills, *Salford, MANCHESTER.*
Also IRON and STEEL WIRE of all descriptions.

HEATHCOTE GAS COAL
from the
GRASSMOOR COLLIERIES,
CHESTERFIELD.
Rich in Illuminating Power and Yield of Gas.
Above the Average in Weight and Quality of Coke.
Maintains a High Standard in Residuals.

TROTTER, HAINES, & CORBETT,
BRETTELL'S ESTATE, Limited,
FIRE-CLAY & BRICK WORKS,
STOURBRIDGE.
Manufacturers of GAS RETORTS, GLASSHOUSE FURNACE & BLAST-FURNACE BRICKS, LUMPS, TILES, and every description of FIRE-BRICKS.
Special Lumps, Tiles, and Bricks for Regenerative and Furnace Work.
Shipments Promptly and Carefully Executed.
London Office: E. C. Brown & Co., Leadenhall Chambers, 4, St. Mary Axe, E.C.

NEWBATTLE CANNEL.
Highest Results in Gas, & Excellent Coke.
QUOTATIONS ON APPLICATION TO
THE LOTHIAN COAL COMPANY,
LIMITED,
NEWBATTLE COLLIERIES,
NEWTONGRANGE, MIDLOTHIAN.

JAMES OAKES & CO.,
ALFRETON IRON-WORKS, DERBYSHIRE,
AND
Wenlock Iron Wharf, 21 & 22, Wharf Road, CITY ROAD, LONDON, N.
Manufacture and keep in Stock at their Works (also large Stock in London)
PIPES and CONNECTIONS, 1½ to 48 inches in diameter, and make and erect to order RETORTS, PURIFIERS, and TANKS, with or without planed joints, COLUMNS, GIRDERS, SPECIAL CASTINGS, &c., required by Gas, Water, Railway, Telegraph, Chemical, Colliery, and other Companies.
Note.—Makers of HORSLEY SYPHONS. These are cast in one piece, without Chaplets; doing away with Bolts, Nuts, and Covers, and rendering Leakage impossible.

THOMAS TURTON AND SONS, Limited,
SHEAF WORKS, SHEFFIELD,
MANUFACTURERS OF
FILES OF BEST QUALITY
FOR ENGINEERS.
STEEL OF ALL DESCRIPTIONS.
SCREW STOCKS, TAPS AND DIES,
SPANNERS, RATCHET BRACES, LIFTING JACKS,
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AND ENGINEERS' TOOLS GENERALLY.
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HARRIS & PEARSON,
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MANUFACTURERS OF
FIRE-CLAY GAS-RETORTS, FIRE-BRICKS, LUMPS, & TILES of Every Description.
GLAZED BRICKS AND PORCELAIN BATHS.

Workmanship and Materials of the Highest Quality.
PECKETT'S LOCOMOTIVES.
Built to any Specification or Gauge.
PECKETT & SONS,
ATLAS LOCOMOTIVE WORKS, BRISTOL.

GRAETZIN LIGHT

Important Improvements.

BURNERS.

1. **20-Candle Power more light** without increase in the consumption of gas.
2. **Patent Gas Adjuster;** cannot get out of order.
3. **Automatic Gas Regulator,** ensures a constant and unvarying pressure of 35 mm., guarantees a steady light, at the same time obviating waste of gas and blackening of the burner.
4. **Accurate Regulation of the Air Supply.**
5. Burners will be supplied either with Gas Adjuster or Automatic Gas Regulator.
6. The brass casing is heatproof, and, if occasionally cleaned with warm water, will not become discoloured.

LAMPS.

From Lamps with more than one burner, the injectors can be removed from the outside, without taking the lamps to pieces.

THE GLENBOIG UNION FIRE-CLAY CO., LTD.

GLENBOIG FIRE-BRICKS AND GAS-RETORTS.

Every Genuine Glenboig Brick, Block, Gas-Retort, &c., is legibly stamped with one or other of the Glenboig Company's Registered Trade Marks, as here shown.

TRADE MARKS.

The Glenboig Trade Marks are imitated, and the Glenboig Name unfairly used by Makers of a lower Class of Goods, which, when sold under their own name, command much lower prices.
The Genuine Brand, Stamped on the Goods, is the only Reliable Guarantee to the Purchaser.

GAS-RETORTS, FIRE-BRICKS, BLOCKS, &c., &c.

The SPECIAL BRICKS used in the Construction of Gas Furnaces for Heating Retorts.

GLENBOIG BRICKS

Works: GLENBOIG, LANARKSHIRE.
Offices: 48, West Regent St., Glasgow.

56 Prize Medals and Diplomas of Honour.
Highest Award wherever exhibited.

The GLENBOIG BRICKS, BLOCKS, AND RETORTS combine, in the highest degree, the qualities of not melting, and not splitting, when subjected to the highest heats and most sudden changes of temperature, and are, in consequence, found to be economical, even in districts where the local bricks can be had at half the price.

Undernoted we give a Table of Analysis and Physical Characteristics of a sample of Glenboig Fire-Clay by J. T. Norman, London; and, in submitting a report from a responsible and reliable public analyst, we would here draw attention to the unreliable character of some recently published analyses where a manufacturer selects not only his own samples, but also those of his competitor, and has them treated by a private analyst. SUCH STATEMENTS ARE ALTOGETHER UNTRUSTWORTHY.

ANALYSIS OF GLENBOIG FIRE-CLAY.

By JOHN T. NORMAN, Esq., F.C.S., &c., The City Central Laboratory, LONDON.

THE GLENBOIG UNION FIRE-CLAY CO., LTD., GLENBOIG, SCOTLAND.

23, LEADENHALL STREET,
LONDON, E.C., September 21st, 1909.

DEAR SIRS,

I have completed the investigation of the samples of Clay received from you on the 10th inst., and now beg to report the results.

CHEMICAL ANALYSIS.

	Raw.	Fired.
Silica, free	3·03	3·49
Silica, combined	43·20	49·77
Alumina	36·55	42·10
Ferric oxide	1·80	2·08
Titanic oxide	1·30	1·50
Lime	trace	trace
Magnesia	trace	trace
Alkaline oxides	trace	trace
Sulphates as trioxides	0·92	1·06
Loss on Ignition	13·20	—
	100·00	100·00

PHYSICAL RESULTS.

Density	2·65
Volume weight	1·90
Porosity	15·4 %
Linear shrinkage at 100° C.	3·70%
" " " 1050° C.	4·76%
" " " Total	8·46%
Volume shrinkage at 100° C.	10·7 %
" " " 1050° C.	12·6 %
" " " Total	23·3 %
Plasticity	20·0 %
Fire Stability	1850° C. equiv. to 3362° F.

(SEGER CONE 36.) (New Scale CONE 38.)

(Signed) J. T. NORMAN.

This Clay is remarkable for its high percentage of Alumina and for the almost complete absence of ingredients tending to lower the refractory properties; its fire stability is extremely high. For some years past I have been urging clients who are working the Clays of the Coal Measures to search for such a material, but you are the first to discover a supply. The possession of this Clay places you in a unique position amongst the manufacturers of refractory goods throughout the world, and I have no doubt will, if duly exploited, enable you to drive out of the market the large quantities of foreign fire-bricks which are being poured into this country for use in the construction of bye-product ovens and for other purposes.—I am, yours faithfully,

JOHN T. NORMAN.

ADDITIONAL REVENUE FOR GAS-WORKS.

COKE SELLING . . AT 11/6 A TON
COALEXLD SELLING AT 20/- A TON
IN THE SAME TOWN.

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LANCASTER.

S. S. STOTT & CO.,

ENGINEERS,
HASLINGDEN, nr. MANCHESTER.

LIME & OXIDE ELEVATORS & CONVEYORS.
COAL AND COKE STORAGE PLANTS.
Coal and Coke Elevators and Conveyors.
STAMPED AND RIVETED STEEL ELEVATOR BUCKETS.
DETACHABLE CHAINS AND SPROCKET WHEELS.
HIGH-CLASS STEAM ENGINES. BEAM PUMPING-ENGINES, &c.

OUR DISCOUNT SYSTEM GAINS GROUND DAY BY DAY.

Greatly increases Sale of Gas.

Particulars and fullest description on application.

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GAS COAL AND CANNEL.

WILSON CARTER & PEARSON,
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Gas, Steam, and other Fuel for Home and Export.
GAS COKE CONTRACTORS.
Chief Offices: 50, NEW STREET, BIRMINGHAM.
Telegraphic Address: "CARTER PEARSON, BIRMINGHAM." Telephone Nos.: CENTRAL 3013 and 3014.

The Outcome of a Practical Gas Engineer's Life Experience.

THE CENTENARY PETROL GAS TURBINE GENERATOR.

FOR
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FOR
Villages,
Mansions,
Farm Steadings,
Churches, Schools,
Railway Stations,
County Lighting Districts.

Plants from 100 cub. ft. per hour up to 50,000 cub. ft. per hour for Gas Works.

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WILLIAM KEY, Engineer.

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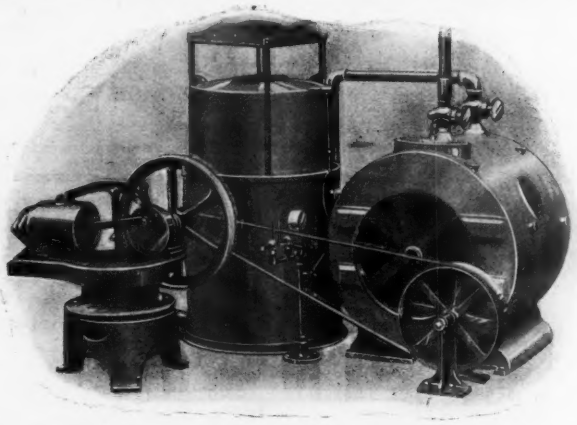
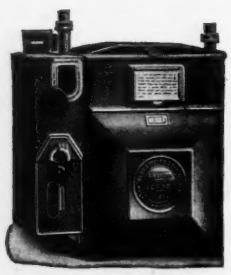


NON-EXPLOSIVE and ECONOMICAL.

SLOT METERS

STATION METERS,
GOVERNORS, &c.



SLOT METER.

DRY METER.

JAMES MILNE & SON, LTD.,

EDINBURGH. LONDON. GLASGOW. LEEDS.

Welsbach
LIGHT
Inverted Arc Lamp, Fig. 623.

Storm Proof—
For Exterior Lighting.

Welsbach-Kern
(Patent) Inverted System

BRITISH MADE.

BRITISH MADE.

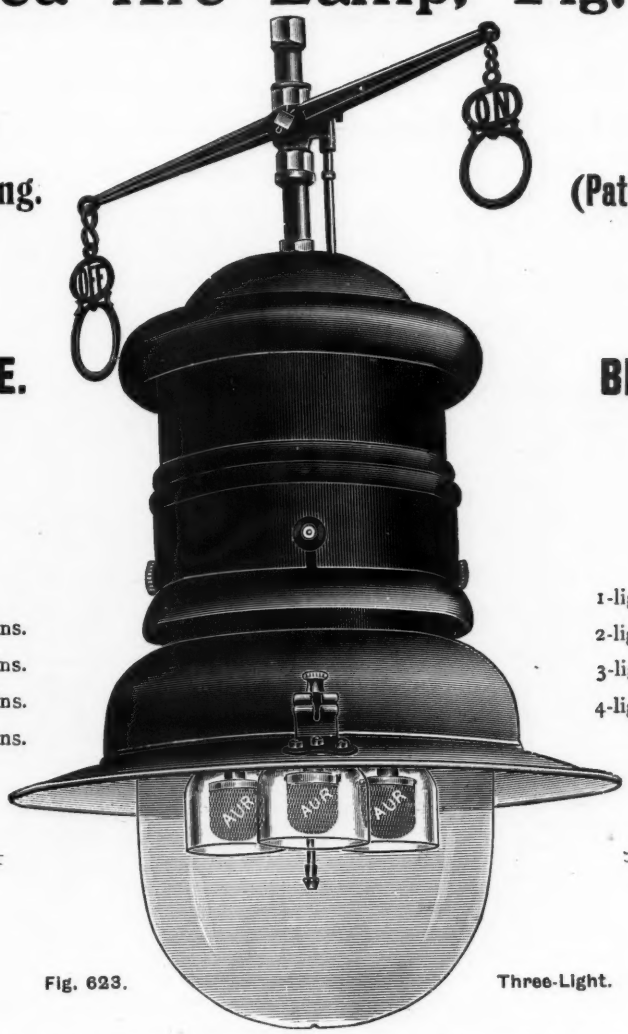


Fig. 623. Three-Light.

Height over all.

1-light . . .	1 ft. 8 ins.
2-light . . .	2 ft. 4 ins.
3-light . . .	2 ft. 4 ins.
4-light . . .	2 ft. 7 ins.

Width over all.

1-light . . .	1 ft. 1 in.
2-light . . .	1 ft. 5 ins.
3-light . . .	1 ft. 5 ins.
4-light . . .	1 ft. 8 ins.

ENAMELLED Green Steel Casing, fitted with Welsbach-Kern Inverted Burners, Gas and Air Regulators operated from outside. Sliding Door to give access to Burners for cleaning purposes. Fitted with Magnesia Nozzles, Welsbach Mantles, and Glass Mantle Protectors. Complete as shown. Highly efficient and regenerative.

	Gas per hour.	*C.P.*	*Steel.*	*Copper Case.*		*Gas per hour.*	*C.P.*	*Steel.*	*Copper Case.*
1-light	4 feet	125	**30/-**	**5/-** extra.	3-light	12 feet	400	**52/6**	**6/-** extra.
2-light	8 feet	260	**47/6**	**6/-** extra.	4-light	16 feet	550	**72/6**	**9/-** extra.

All on or off, or One light on and the rest off, **7/6** per Lamp extra. Cup and Ball, **3/6** per Lamp extra.

RENEWALS.

Glass Mantle Protectors (Fig. 623) **3/4½** per dozen, or in case lots of 5 gross, **33/-** per gross.

	1-Light.	*2-Light.*	*3-Light.*	*4-Light.*		*1-Light.*	*2-Light.*	*3-Light.*	*4-Light.*
Clear Glass Globes, each	**2/3**	**5/9**	**5/9**	**9/-**	Wired Globes, extra each	**2/-**	**2/-**	**2/9**	**3/6**
" " " In Case lots per dozen.	**19/6**	**57/9**	**57/9**	**93/-**	Parabolic Reflector, extra "	**3/6**	**6/-**	**7/6**	Not made
Case contains . .	*80*	*18*	*18*	*12*	Welsbach Mantles, each **6d.** subject as usual.				

The Welsbach Mantles for Upright lighting are "C," "CX," and "Plaissetty," price **4½d.** each.

THE WELSBACH INCANDESCENT GAS LIGHT CO., LTD.,
Welsbach House, 344-354, Gray's Inn Road, London, W.C.

Telegrams and Cables: "WELSBA ONDON." *Telephone 2410 NORTH.*

Munich Inclined Chamber Furnaces.

Plants already built and under Construction:

Total capacity: 45,000,000 c.ft. of pure Coal Gas per 24 hours.

The following Cities have adopted Munich Chamber furnaces: { Berlin, Hamburg (second order), Paris, Munich, Kierstein, Moosach, Leipsig, Rome, Hanau, Regensburg.

For Particulars and Tenders apply to:

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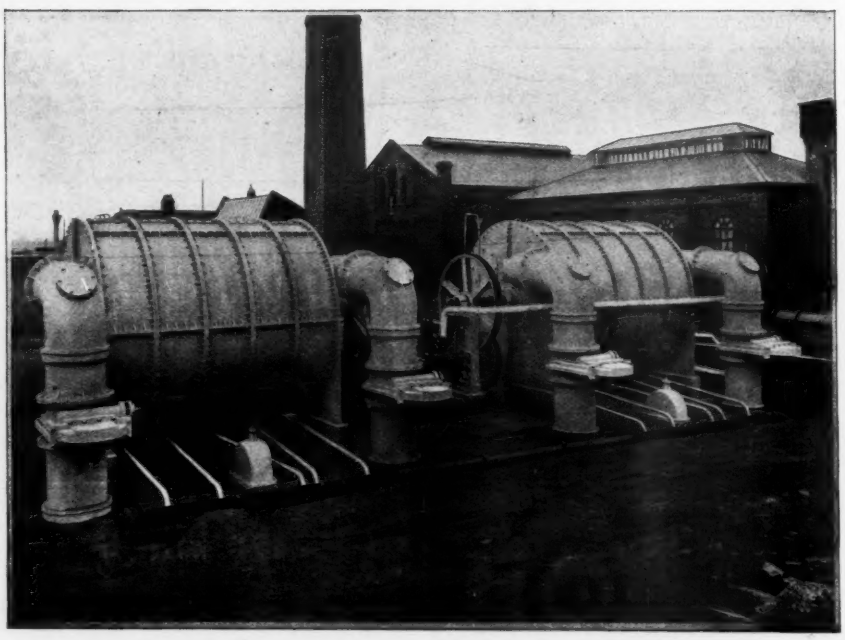
THE WHESSOE FOUNDRY CO., LTD.,

Works: DARLINGTON.

LARGE AREA OF WASHING SURFACE.

REMOVAL OF THE WHOLE OF THE AMMONIA AND A LARGE PERCENTAGE OF CO_2 AND SH_2.



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BUNDLES EASILY ACCESSIBLE FOR CLEANING.

"Whessoe" Twin Rotary Washer-Scrubber (Patent No. 24,110 of 1903). **Combined capacity 3,000,000 cub. ft. per diem,** as supplied to The Walker and Wallsend Gas Company, Newcastle-on-Tyne.

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RADIATE MORE HEAT

BY USING

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SILCO BRICKS prevent all settling of setting.

SILICA BRICKS for Combustion Chambers, any shape.

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— LEEDS. —

RETORT BUILDERS ON THE

INCLINED, HORIZONTAL, OR VERTICAL

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Contractors to the Vertical Gas Retort Syndicate, Ltd., for all BRICKWORK in the

DESSAU VERTICAL RETORT INSTALLATIONS.

See Certified Results of the first Installation on this System in England erected at The Ayres Quay Gas-Works, Sunderland.

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COAL & COKE CONVEYING PLANTS

COMPLETE WITH

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STEEL STRUCTURAL WORK. ROOFS, &c.

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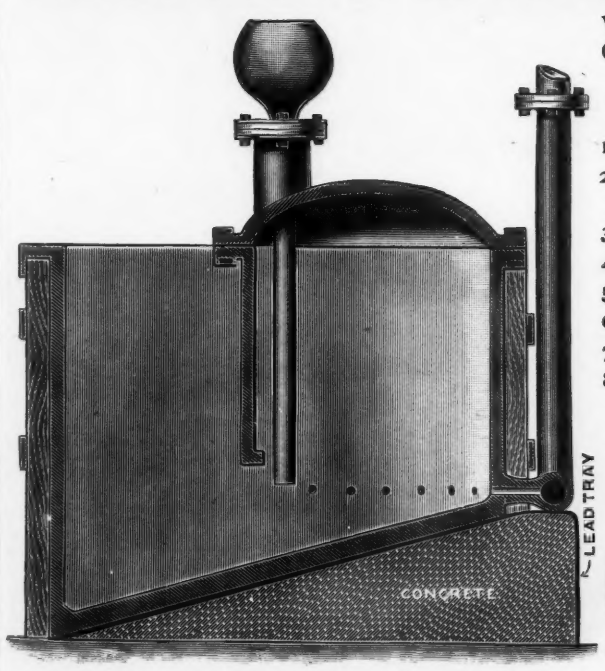
BIRMINGHAM.

LAPWELDED AND RIVETED STEEL PIPES.

HUMPHREYS & GLASGOW'S CARBURETTED WATER-GAS PLANTS.

Aggregate Capacity of Plants supplied **231,600,000** cubic feet Daily.

SULPHATE OF AMMONIA PLANT



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Williams' and Fenner's Patent Saturator with Outside Cracker Pipe, having the following

ADVANTAGES:—

1. **Equal distribution of Steam and Ammonia.**
2. **Perfect agitation and boiling of the Acid Liquor.**
3. **No possibility of local Alkalinity.**
4. **Consequently no formation of Blue Salt.**
5. **Sulphate is easily forced to point of discharge.**
6. **No incrustation.**
7. **No renewals of Cracker Pipe.**
8. **Capacity of output greatly increased.**

IT CAN BE APPLIED TO ANY EXISTING SATURATOR.

LICENCES TO MAKE MAY BE OBTAINED.

For full Particulars apply to the Sole Proprietors

BIGGS, WALL & CO.

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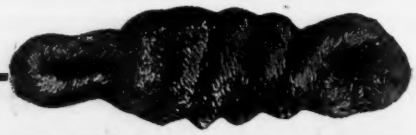

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Is sent out in Skeins all ready for use.
Every Skein of equal weight and length.
The Lead Wool Joint is built up evenly all the way through.
Lead Wool requires no melting and can be used in water without risk.

Lead Wool Joints are Twice as Strong as Cast Lead Joints and cost 33⅓ per cent. less.

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Fitted with

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THE STRONGEST AND BEST PREVENTIVE AGAINST THEFTS FROM SLOT METERS.

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DO YOU USE STEEL TUBES

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If you use them in such a position, where their durability is tried most severely, why not for your ordinary Mains and services? They are far cheaper and more reliable under all conditions if they are

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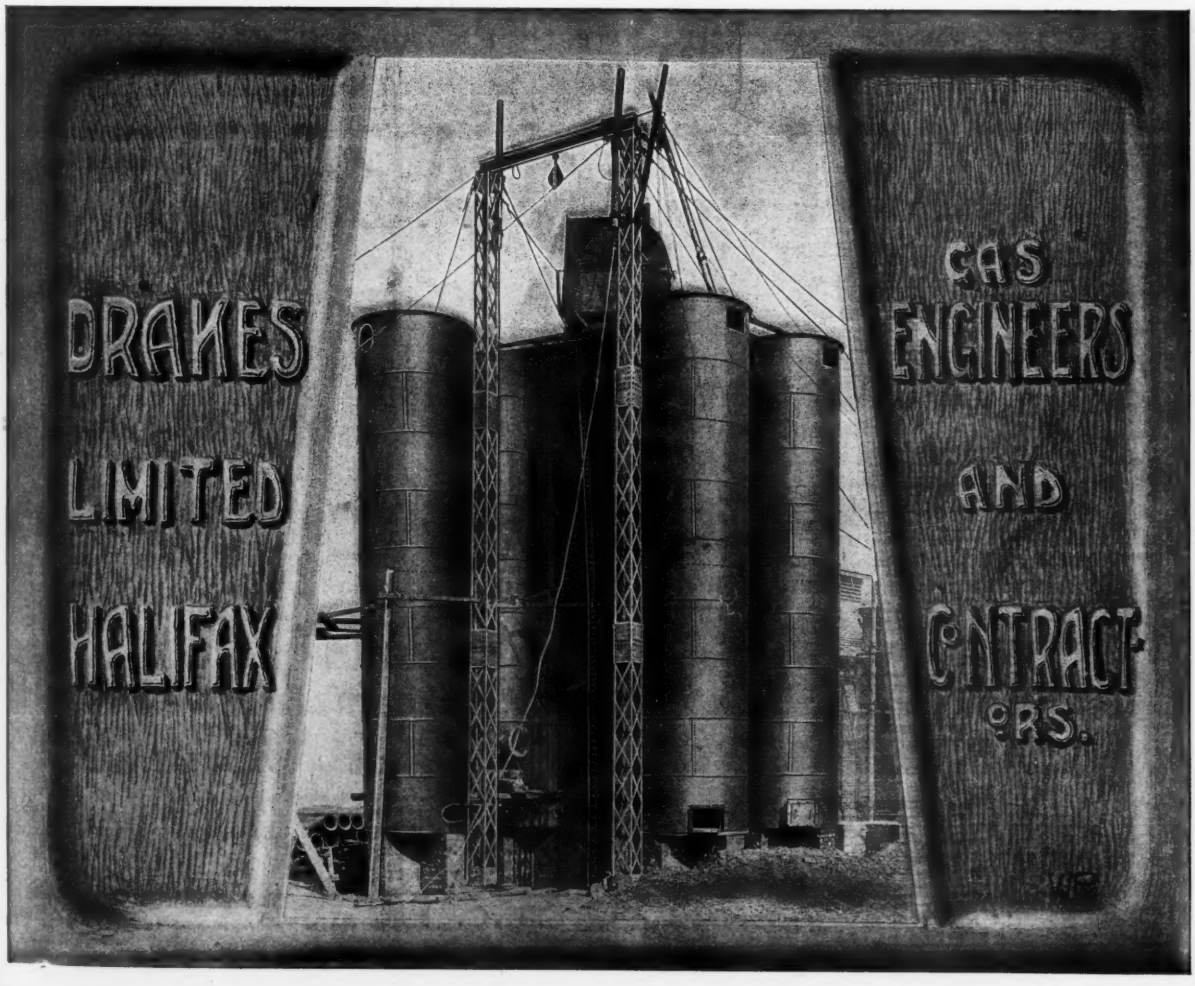

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IN

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GLOVER-WEST PATENTS.

Description and Particulars of Tests will be forwarded on request.

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